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ABSTRACT

This Alberta curriculum guide defines competencies that help students build daily living skills, investigate career options in energy and mines, use technology in the fields of energy and mining effectively and efficiently, and prepare for entry into the workplace or related postsecondary programs in the field. The first section provides a program rationale and philosophy for career and technology studies, general learner expectations, program organization information, curriculum and assessment standards, and types of competencies. The second section provides a comprehensive view of energy and mineral development in Alberta and Canada, including rationale and philosophy for the energy and mines strand, strand organization, and planning for instruction. The 26 modules are organized into introductory, intermediate, and advanced levels that cover a comprehensive set of competencies in the field of energy and mines on the following topics: resource exploration, recovery, production, marketing and management, and conservation. Modules also define exit-level competencies, specify prerequisites, and outline specific learner expectations. Other sections of the guide contain the following: module curriculum and assessment standards; assessment tools; linkages and transitions with other strands, other educational programs, and to the community, the workplace and the credentialing process; a learning resource guide listing 48 resources keyed to modules, plus sources for further information; and sample student learning guides. (KC)

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ED 412 420

CAREER & TECHNOLOGY STUDIES

ENERGY AND MINES

GUIDE TO STANDARDS AND IMPLEMENTATION

1997

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This document was prepared for:

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Teachers	✓

Program/Level: Career and Technology Studies/Secondary

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This document supersedes all previous versions of the *Career & Technology Studies Guide to Standards and Implementation*.

This publication is a support document. The advice and direction offered is suggestive except where it duplicates the Program of Studies. The Program of Studies—a prescriptive description of the expectations of student learning, focusing on what students are expected to know and be able to do—is issued under the authority of the Minister of Education pursuant to section 25(1) of the *School Act*, Statutes of Alberta, 1988, Chapter S-3.1 as amended, and is required for implementation. **Within this document, the Program of Studies is shaded so that the reader may readily identify all prescriptive statements or segments.**

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CAREER AND TECHNOLOGY STUDIES

A. PROGRAM RATIONALE AND PHILOSOPHY

Through Career and Technology Studies (CTS), secondary education in Alberta is responding to the many challenges of modern society, helping young people develop daily living skills and nurturing a flexible, well-qualified work force.

In Canada's information society, characterized by rapid change in the social and economic environment, students must be confident in their ability to respond to change and successfully meet the challenges they face in their own personal and work lives. In particular, they make decisions about what they will do when they finish high school. Many students will enter the work force, others will continue their education. All students face the challenges of growing independence and responsibility, and of entering post-secondary programs and/or the highly competitive workplace.

Secondary schools also face challenges. They must deliver, on a consistent basis, high quality, cost-effective programs that students, parents and the community find credible and relevant.

CTS helps schools and students meet these challenges. Schools can respond more efficiently and effectively to student and community needs and expectations by taking advantage of the opportunities in the CTS curriculum to design courses and access school, community and distance learning resources. Students can develop the confidence they need as they move into adult roles by assuming increased responsibility for their learning; cultivating their individual talents, interests and abilities; and by defining and acting on their goals.

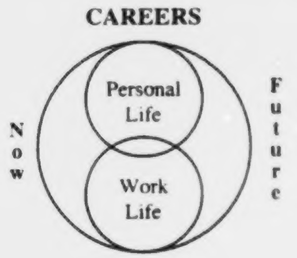
As an important component of education in Alberta secondary schools, CTS promotes student achievement by setting clear expectations and recognizing student success. Students in CTS develop competencies—the knowledge, skills and attitudes they are expected to demonstrate, that is, what they know and what they are able to do.

Acquired competencies can be applied now and in the future as students make a smooth transition into adult roles in the family, community, workplace and/or further education. To facilitate this transition, clearly stated expectations and standards have been defined in cooperation with teachers, business and industry representatives and post-secondary educators.

CTS offers all students important learning opportunities. Regardless of the particular area of study chosen, *students* in CTS *will*:

- develop skills that can be applied in their daily lives, now and in the future
- refine career-planning skills
- develop technology-related skills
- enhance employability skills
- apply and reinforce learnings developed in other subject areas.

In CTS, students build skills they can apply in their everyday lives. For example, in the CTS program, particularly at the introductory levels, students have the opportunity to improve their ability to make sound consumer decisions and to appreciate environmental and safety precautions.

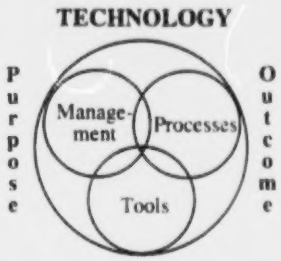


A career encompasses more than activities just related to a person's job or occupation; it involves one's personal life in both local and global contexts; e.g., as a family member, a friend, a community volunteer, a citizen of the world.

The integration of careers throughout the CTS program helps students to make effective career decisions and to target their efforts. CTS students will have the opportunity to expand their knowledge about careers, occupations and job opportunities, as well as the education and/or training requirements involved. Also, students come to recognize the need for lifelong learning.

Students in CTS have the opportunity to use and apply technology and systems effectively and efficiently. This involves:

- a decision regarding which processes and procedures best suit the task at hand
- the appropriate selection and skilled use of the tools and/or resources available
- an assessment of and management of the impact the use of the technology may have on themselves, on others and on the environment.



Integrated throughout CTS are employability skills, those basic competencies that help students develop their personal management and social skills. Personal management skills are improved as students take increased responsibility for their learning, design innovative solutions to problems and challenges, and manage resources effectively and efficiently. Social skills improve through learning experiences that require students to work effectively with others, demonstrate teamwork and leadership, and maintain high standards in safety and accountability.

As well as honing employability skills, CTS reinforces and enhances learnings developed in core and other complementary courses. The curriculum emphasizes, as appropriate, the effective application of communication and numeracy skills.

In addition to the common outcomes described above, students focusing on a particular area of study will develop career-specific competencies that support entry into the workplace and/or related post-secondary programs. Career-specific competencies can involve understanding and applying appropriate terminology, processes and technologies related to a specific career, occupation or job.

GENERAL LEARNER EXPECTATIONS

General learner expectations describe the basic competencies integrated throughout the CTS program.

Within an applied context relevant to personal goals, aptitudes and abilities; *the student* in CTS *will*:

- demonstrate the basic knowledge, skills and attitudes necessary for achievement and fulfillment in personal life
- develop an action plan that relates personal interests, abilities and aptitudes to career opportunities and requirements
- use technology effectively to link and apply appropriate tools, management and processes to produce a desired outcome
- develop basic competencies (employability skills), by:
    - selecting relevant, goal-related activities, ranking them in order of importance, allocating necessary time, and preparing and following schedules (managing learning)
    - linking theory and practice, using resources, tools, technology and processes responsibly and efficiently (managing resources)
    - applying effective and innovative decision-making and problem-solving strategies in the design, production, marketing and consumption of goods and services (problem solving and innovation)
    - demonstrating appropriate written and verbal skills, such as composition, summarization and presentation (communicating effectively)
    - participating as a team member by working cooperatively with others and contributing to the group with ideas, suggestions and effort (working with others)
    - maintaining high standards of ethics, diligence, attendance and punctuality, following safe procedures consistently, and recognizing and eliminating potential hazards (demonstrating responsibility).

PROGRAM ORGANIZATION

CURRICULUM STRUCTURE

Career and Technology Studies is organized into **strands** and **modules**.

Strands in CTS define competencies that help students:

- build daily living skills
- investigate career options
- use technology (managing, processes, tools) effectively and efficiently
- prepare for entry into the workplace and/or related post-secondary programs.

In general, strands relate to selected industry sectors offering positive occupational opportunities for students. Some occupational opportunities require further education after high school, and some allow direct entry into the workplace. Industry sectors encompass goods-producing industries, such as agriculture, manufacturing and construction; and service-producing industries, such as business, health, finance and insurance.

Modules are the building blocks for each strand. They define what a student is expected to know and be able to do (exit-level *competencies*). Modules also specify prerequisites. Recommendations for module parameters, such as instructional qualifications, facilities and equipment can be found in the guides to implementation.

The competencies a student must demonstrate to achieve success in a module are defined through the *module learner expectations*. Senior high school students who can demonstrate the module learner expectations; i.e., who have the designated competencies, will qualify for one credit toward their high school diploma.

Specific learner expectations provide a more detailed framework for instruction. Within the context of module learner expectations, the specific learner expectations further define the knowledge, skills and attitudes the student should acquire.

The following chart shows the 22 strands that comprise the CTS program and the number of modules available in each strand.

Strand	No. of Modules
1. Agriculture	33
2. Career Transitions	28
3. Communication Technology	33
4. Community Health	31
5. Construction Technologies	46
6. Cosmetology	58
7. Design Studies	31
8. Electro-Technologies	37
9. Energy and Mines	26
10. Enterprise and Innovation	8
11. Fabrication Studies	41
12. Fashion Studies	29
13. Financial Management	14
14. Foods	37
15. Forestry	21
16. Information Processing	48
17. Legal Studies	13
18. Logistics	12
19. Management and Marketing	19
20. Mechanics	54
21. Tourism Studies	24
22. Wildlife	17

LEVELS OF ACHIEVEMENT

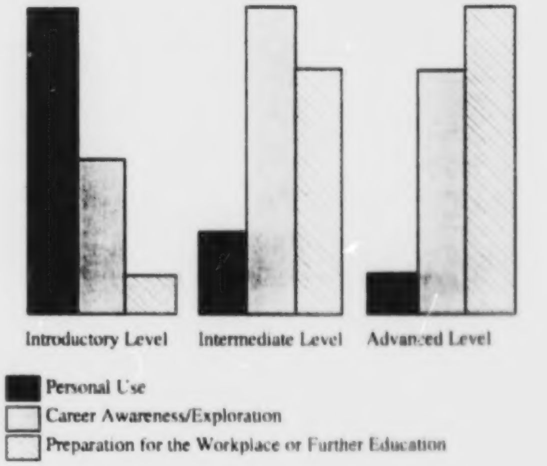
Modules are organized into three levels of achievement: **introductory**, **intermediate** and **advanced**. As students progress through the levels, they will be expected to meet higher standards and demonstrate an increased degree of competence, in both the general learner expectations and the module learner expectations.

Introductory level modules help students build daily living skills and form the basis for further learning. Introductory modules are for students who have no previous experience in the strand.

Intermediate level modules build on the competencies developed at the introductory level. They provide a broader perspective, helping students recognize the wide range of related career opportunities available within the strand.

Advanced level modules refine expertise and help prepare students for entry into the workplace or a related post-secondary program.

The graph below illustrates the relative emphasis on the aspects of career planning at each of the levels.



CURRICULUM AND ASSESSMENT STANDARDS

Curriculum standards in CTS define what students must know and be able to do. Curriculum standards are expressed through general learner expectations for CTS, and through module and specific learner expectations for each strand.

Assessment standards define how student performance is to be judged. In CTS, each assessment standard defines the conditions and criteria to be used for assessing the competencies of each module learner expectation. To receive credit for a module, students must demonstrate competency at the level specified by the conditions and criteria defined for each module learner expectation.

Students throughout the province receive a fair and reliable assessment as they use the standards to guide their efforts, thus ensuring they participate more effectively and successfully in the learning and assessment process. Standards at advanced levels are, as much as possible, linked to workplace and post-secondary entry-level requirements.

TYPES OF COMPETENCIES

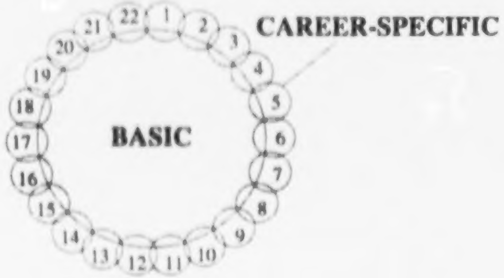
Two types of competencies are defined within the CTS program: basic and career-specific.

Basic competencies are generic to any career area and are developed within each module. Basic competencies include:

- personal management; e.g., managing learning, being innovative, ethics, managing resources
- social; e.g., communication, teamwork, leadership and service, demonstrating responsibility (safety and accountability).

Career-specific competencies relate to a particular strand. These competencies build daily living skills at the introductory levels and support the smooth transition to the workplace and/or post-secondary programs at the intermediate and advanced levels.

The model below shows the relationship of the two types of competencies within the 22 strands of the CTS program.



BASIC COMPETENCIES REFERENCE GUIDE

The chart below outlines basic competencies that students endeavour to develop and enhance in each of the CTS strands and modules. Students' basic competencies should be assessed through observations involving the student, teacher(s), peers and others as they complete the requirements for each module. In general, there is a progression of task complexity and student initiative as outlined in the Developmental Framework★. **As students progress through Stages 1, 2, 3 and 4 of this reference guide, they build on the competencies gained in earlier stages.** Students leaving high school should set themselves a goal of being able to demonstrate Stage 3 performance.

Suggested strategies for classroom use include:

- having students rate themselves and each other
- using in reflective conversation between teacher and student
- highlighting areas of strength
- tracking growth in various CTS strands
- highlighting areas upon which to focus
- maintaining a student portfolio.

Stage 1— *The student:*	**Stage 2**— *The student:*	**Stage 3**— *The student:*	**Stage 4**— *The student:*
Managing Learning			
☐ comes to class prepared for learning	☐ ——▶——▶	☐ ——▶——▶	☐ ——▶——▶
☐ follows basic instructions, as directed	☐ follows instructions, with limited direction	☐ follows detailed instructions on an independent basis	☐ ——▶——▶
	☐ sets goals and establishes steps to achieve them, with direction	☐ sets clear goals and establishes steps to achieve them	☐ demonstrates self-direction in learning, goal setting and goal achievement
☐ acquires specialized knowledge, skills and attitudes	☐ applies specialized knowledge, skills and attitudes in practical situations	☐ transfers and applies specialized knowledge, skills and attitudes in a variety of situations	☐ transfers and applies learning in new situations; demonstrates commitment to lifelong learning
☐ identifies criteria for evaluating choices and making decisions	☐ identifies and applies a range of effective strategies for solving problems and making decisions	☐ uses a range of critical thinking skills to evaluate situations, solve problems and make decisions	☐ thinks critically and acts logically to evaluate situations, solve problems and make decisions
☐ uses a variety of learning strategies	☐ explores and uses a variety of learning strategies, with limited direction	☐ selects and uses effective learning strategies	☐ ——▶——▶
		☐ cooperates with others in the effective use of learning strategies	☐ provides leadership in the effective use of learning strategies
Managing Resources			
☐ adheres to established timelines; uses time/schedules/planners effectively	☐ creates and adheres to timelines, with limited direction; uses time/schedules/planners effectively	☐ creates and adheres to detailed timelines on an independent basis; prioritizes task; uses time/schedules/planners effectively	☐ creates and adheres to detailed timelines; uses time/schedules/planners effectively; prioritizes tasks on a consistent basis
☐ uses information (material and human resources), as directed	☐ accesses and uses a range of relevant information (material and human resources), with limited direction	☐ accesses a range of information (material and human resources), and recognizes when additional resources are required	☐ uses a wide range of information (material and human resources) in order to support and enhance the basic requirement
☐ uses technology (facilities, equipment, supplies), as directed, to perform a task or provide a service	☐ uses technology (facilities, equipment, supplies), as appropriate, to perform a task or provide a service, with minimal assistance and supervision	☐ selects and uses appropriate technology (facilities, equipment, supplies) to perform a task or provide a service on an independent basis	☐ recognizes the monetary and intrinsic value of managing technology (facilities, equipment, supplies)
☐ maintains, stores and/or disposes of equipment and materials, as directed	☐ maintains, stores and/or disposes of equipment and materials, with limited assistance	☐ maintains, stores and/or disposes of equipment and materials on an independent basis	☐ demonstrates effective techniques for managing facilities, equipment and supplies
Problem Solving and Innovation			
☐ participates in problem solving as a process ☐ learns a range of problem-solving skills and approaches	☐ identifies the problem and selects an appropriate problem-solving approach, responding appropriately to specified goals and constraints	☐ thinks critically and acts logically in the context of problem solving	☐ identifies and resolves problems efficiently and effectively
☐ practices problem-solving skills by responding appropriately to a clearly defined problem, specified goals and constraints, by: – generating alternatives – evaluating alternatives – selecting appropriate alternative(s) – taking action	☐ applies problem-solving skills to a directed or a self-directed activity, by: – generating alternatives – evaluating alternatives – selecting appropriate alternative(s) – taking action	☐ transfers problem-solving skills to real-life situations, by generating new possibilities ☐ prepares implementation plans ☐ recognizes risks	☐ identifies and suggests new ideas to get the job done creatively, by: – combining ideas or information in new ways – making connections among seemingly unrelated ideas – seeking out opportunities in an active manner

Stage 1— *The student:*	**Stage 2—** *The student:*	**Stage 3—** *The student:*	**Stage 4—** *The student:*
Communicating Effectively			
☐ uses communication skills; e.g., reading, writing, illustrating, speaking	☐ communicates thoughts, feelings and ideas to justify or challenge a position, using written, oral and/or visual means	☐ prepares and effectively presents accurate, concise, written, visual and/or oral reports providing reasoned arguments	☐ negotiates effectively, by working toward an agreement that may involve exchanging specific resources or resolving divergent interests
☐ uses language in appropriate context	☐ uses technical language appropriately	☐ encourages, persuades, convinces or otherwise motivates individuals	☐ negotiates and works toward a consensus
☐ listens to understand and learn	☐ listens and responds to understand and learn	☐ listens and responds to understand, learn and teach	☐ listens and responds to understand, learn, teach and evaluate
☐ demonstrates positive interpersonal skills in selected contexts	☐ demonstrates positive interpersonal skills in many contexts	☐ demonstrates positive interpersonal skills in most contexts	☐ promotes positive interpersonal skills among others
Working with Others			
☐ fulfills responsibility in a group project	☐ ——→——→	☐ seeks a team approach, as appropriate, based on group needs and benefits; e.g., idea potential, variety of strengths, sharing of workload	☐ leads, where appropriate, mobilizing the group for high performance
☐ works collaboratively in structured situations with peer members	☐ cooperates to achieve group results	☐ works in a team or group: – encourages and supports team members – helps others in a positive manner – provides leadership/followership as required – negotiates and works toward consensus as required	☐ understands and works within the context of the group
☐ acknowledges the opinions and contributions of others in the group	☐ maintains a balance between speaking, listening and responding in group discussions		☐ prepares, validates and implements plans that reveal new possibilities
	☐ respects the feelings and views of others		
Demonstrating Responsibility			
Attendance			
☐ demonstrates responsibility in attendance, punctuality and task completion	☐ ——→——→	☐ ——→——→	☐ ——→——→
Safety			
☐ follows personal and environmental health and safety procedures	☐ recognizes and follows personal and environmental health and safety procedures	☐ establishes and follows personal and environmental health and safety procedures	☐ transfers and applies personal and environmental health and safety procedures to a variety of environments and situations
☐ identifies immediate hazards and their impact on self, others and the environment	☐ identifies immediate and potential hazards and their impact on self, others and the environment	☐ ——→——→	☐ ——→——→
☐ follows appropriate/emergency response procedures	☐ ——→——→	☐ ——→——→	☐ ——→——→
			☐ demonstrates accountability for actions taken to address immediate and potential hazards
Ethics			
☐ makes personal judgements about whether or not certain behaviours/actions are right or wrong	☐ assesses how personal judgements affect other peer members and/or family; e.g., home and school	☐ assesses the implications of personal/group actions within the broader community; e.g., workplace	☐ analyzes the implications of personal/group actions within the global context
			☐ states and defends a personal code of ethics as required

*** Developmental Framework**			
• *Simple task* • *Structured environment* • *Directed learning*	• *Task with limited variables* • *Less structured environment* • *Limited direction*	• *Task with multiple variables* • *Flexible environment* • *Self-directed learning, seeking assistance as required*	• *Complex task* • *Open environment* • *Self-directed/self-motivated*

ENERGY AND MINES

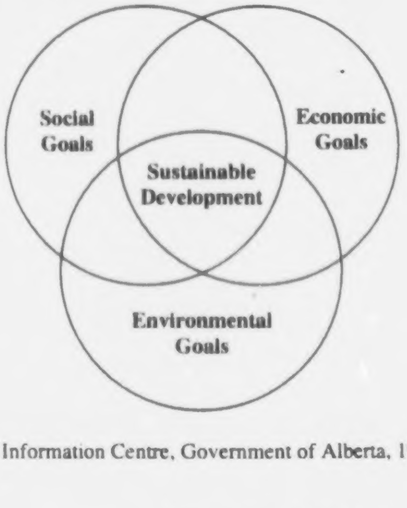
B. STRAND RATIONALE AND PHILOSOPHY

Alberta's hydrocarbon resources are primary energy sources for Alberta and the rest of Canada and contribute to an important export market. Because our province is so richly endowed with oil, gas, oil sands, heavy oil and coal, the exploration, recovery, production, marketing and management of these resources will likely continue to provide a major contribution to Alberta's economy for the foreseeable future.*

Although Alberta owes much of its present development, lifestyle and demographics to the development of fossil fuels, these resources may, over time, become less readily available and more costly to develop and use. Furthermore, public concern for the environment at local and global levels has expanded to embrace practices that ensure sustainable energy use. The development of renewable energy—the energy generated by water, wind, sun, biomass, waste material and geothermal sources—has the potential to extend the life of Alberta's fossil fuels and supplement conventional energy supplies in specific regions of the province.

The potential of the minerals sector in Alberta has not been fully determined, nor have known deposits been fully developed. In the future, development of metallic, nonmetallic and structural materials could be profoundly important to economic diversification, employment and technological development in Alberta. At present, the recovery and production of minerals for industrial applications have significant effects on Alberta's economy.

Energy and Mines, a strand in Career and Technology Studies, provides a comprehensive view of energy and mineral development in Alberta and Canada. It encompasses resource exploration, recovery, production, marketing and management. Conservation is viewed throughout the strand as a process for managing human use of natural resources to ensure such use is sustainable. Students will develop first-hand knowledge of practices specific to Alberta's energy and mineral industries and will examine technologies that support sustainable development and efficient use of natural resources.



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* *Alberta in the Global Energy Spectrum*, Edmonton, AB: Alberta Energy Information Centre, Government of Alberta, 1995.

Students in Energy and Mines will develop the knowledge, skills, attitudes, motivation and commitment to work individually and collectively, as private citizens and members of the work force, toward the conservation and responsible use of water, land, air, forests and wildlife. Within the philosophy of Career and Technology Studies, *students* in Energy and Mines *will*:

- develop greater awareness of the economic, environmental and social significance of energy and mineral resources in Alberta and the rest of the world, and develop awareness of factors affecting industry decisions
- describe the characteristics of energy and mineral development in Alberta and Canada, and identify resulting products and services
- describe technologies and research programs designed to enhance the development of a range of products and services and to achieve sustainable use of natural resources
- translate sustainable development and conservation goals into viable plans for developing and marketing energy and mineral products and services
- develop competencies and behaviours that have broad application to environmental career paths, and specific application to careers within Alberta's energy and mineral industries.

STRAND ORGANIZATION

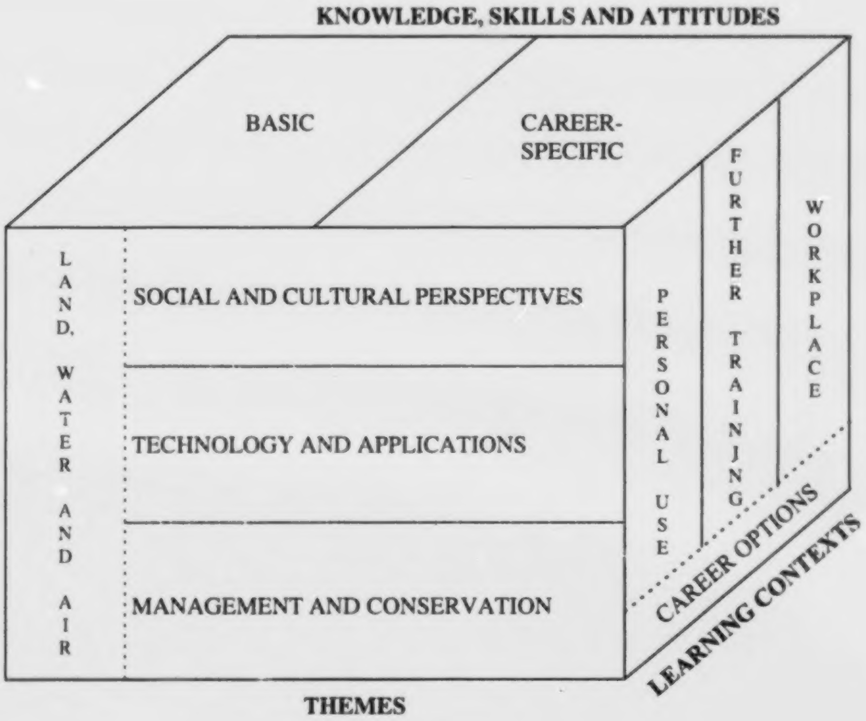
DEVELOPMENT MODEL

The development model depicts three dimensions that provide a basis for selecting and organizing content within the Energy and Mines strand.

- The KNOWLEDGE, SKILLS AND ATTITUDES, represented on the upper face of the model, provide structure for the strand and focus attention on learning goals common to all CTS courses.
- The LEARNING CONTEXTS, represented on the right face of the model, foster the development of knowledge and behaviours that will enable students to meet the demands of daily living, further training and the workplace.
- The THEMES provide situational and concrete learning experiences that support the development of knowledge, skills and attitudes relevant to each of the learning contexts. Each theme focuses attention on a different aspect of sustainable energy and mineral development. Blended together, the themes enable students to understand how it is possible to fulfill social, cultural, aesthetic and economic goals through resource development, while embracing a conservation ethic so as to maintain essential ecological processes, genetic diversity and an adequate resource base for future generations.

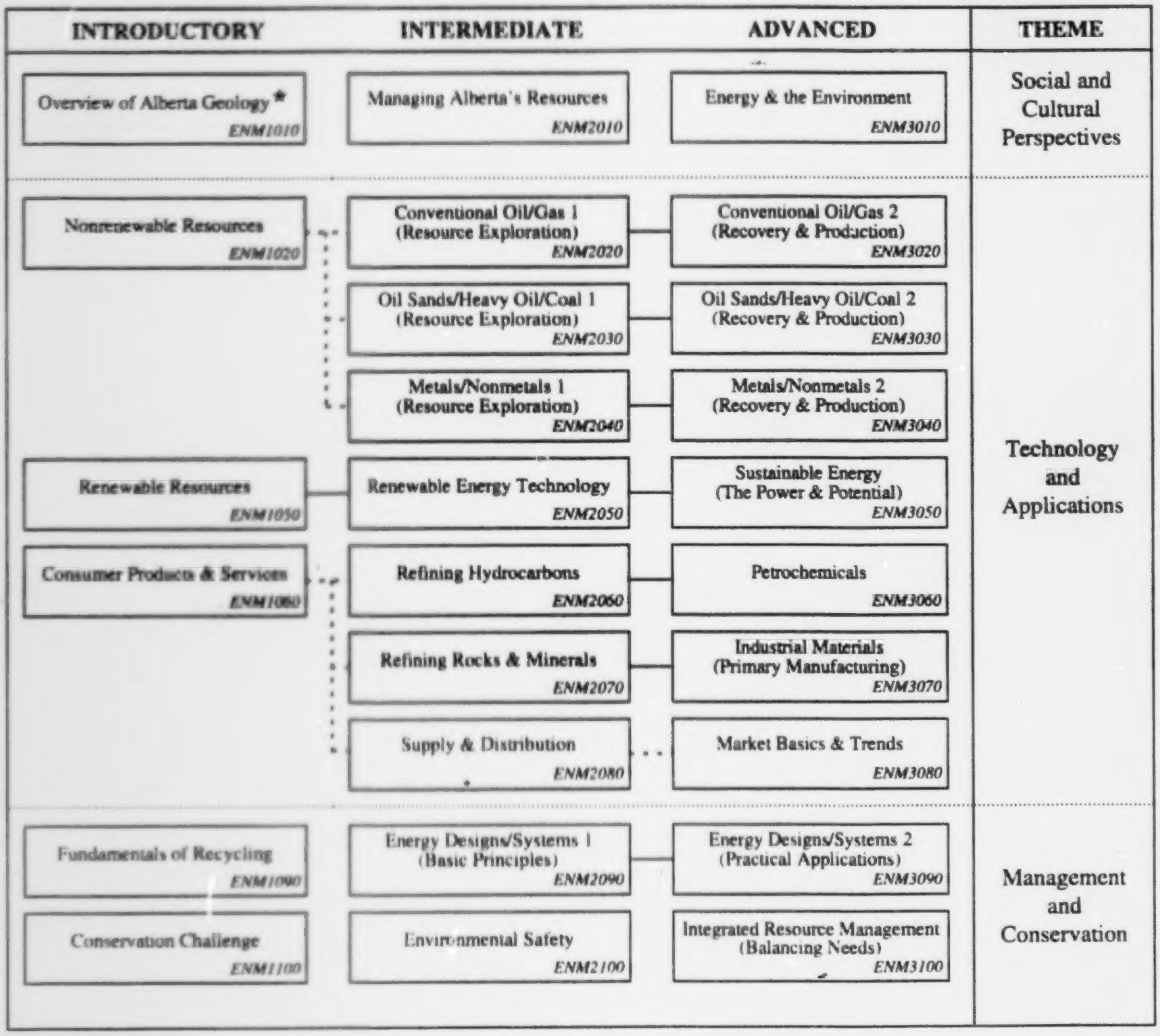
LEVELS

Energy and Mines, like other Career and Technology Studies curricula, is organized into three levels of learning: introductory, intermediate and advanced.


KNOWLEDGE, SKILLS AND ATTITUDES
BASIC
CAREER-SPECIFIC
LAND, WATER AND AIR
SOCIAL AND CULTURAL PERSPECTIVES
TECHNOLOGY AND APPLICATIONS
MANAGEMENT AND CONSERVATION
PERSONAL USE
FURTHER TRAINING
WORKPLACE
CAREER OPTIONS
LEARNING CONTEXTS
THEMES

Introductory modules enable students to survey Alberta's energy and mineral resources, and study sample areas of production, processing and marketing. Students consider the impact of everyday decisions on resource consumption and environmental quality, and develop a problem-solving process for analyzing related issues.

Intermediate and advanced level modules develop more specialized knowledge and skills within areas of resource exploration, recovery, production and marketing. Students examine elements of efficiency and conservation in energy systems, and consider influences of emerging technologies, global trade and environmental sustainability on industry practice and society in general.



INTRODUCTORY	INTERMEDIATE	ADVANCED	THEME
Overview of Alberta Geology * *ENM1010*	Managing Alberta's Resources *ENM2010*	Energy & the Environment *ENM3010*	Social and Cultural Perspectives
Nonrenewable Resources *ENM1020*	Conventional Oil/Gas 1 (Resource Exploration) *ENM2020*	Conventional Oil/Gas 2 (Recovery & Production) *ENM3020*	Technology and Applications
	Oil Sands/Heavy Oil/Coal 1 (Resource Exploration) *ENM2030*	Oil Sands/Heavy Oil/Coal 2 (Recovery & Production) *ENM3030*	
	Metals/Nonmetals 1 (Resource Exploration) *ENM2040*	Metals/Nonmetals 2 (Recovery & Production) *ENM3040*	
Renewable Resources *ENM1050*	Renewable Energy Technology *ENM2050*	Sustainable Energy (The Power & Potential) *ENM3050*	
Consumer Products & Services *ENM1060*	Refining Hydrocarbons *ENM2060*	Petrochemicals *ENM3060*	
	Refining Rocks & Minerals *ENM2070*	Industrial Materials (Primary Manufacturing) *ENM3070*	
	Supply & Distribution *ENM2080*	Market Basics & Trends *ENM3080*	
Fundamentals of Recycling *ENM1090*	Energy Designs/Systems 1 (Basic Principles) *ENM2090*	Energy Designs/Systems 2 (Practical Applications) *ENM3090*	Management and Conservation
Conservation Challenge *ENM1100*	Environmental Safety *ENM2100*	Integrated Resource Management (Balancing Needs) *ENM3100*	

——— Prerequisite . . . . Recommended sequence

* Module provides a strong foundation for further learning in this strand.

MODULE DESCRIPTIONS

Module ENM1010: Overview of Alberta Geology

Students describe the nature and origin of Alberta's energy and mineral resources, explain their significance in society, and identify related career opportunities.

Module ENM1020: Nonrenewable Resources

Students examine general applications of exploration, recovery and production, refining, and reclamation technologies within a nonrenewable energy or mineral industry; and they identify related career opportunities. Potential areas of investigation include conventional crude oil, oil sands, natural gas, coal, nuclear fuels, metallic minerals, nonmetallic minerals and structural materials.

Module ENM1050: Renewable Resources

Students demonstrate applications of one or more renewable energy technologies, examine the contributions of each to sustainable energy development, and identify related career opportunities. Potential areas of investigation include solar, hydro, wind, tidal, biomass and geothermal energy, as well as energy generated from waste.

Module ENM1060: Consumer Products & Services

Students examine the basic techniques involved in developing consumer products and/or services within an energy or mineral industry, and they identify related career opportunities.

Module ENM1090: Fundamentals of Recycling

Students examine opportunities to recycle natural and manufactured materials, and they present the results of research on one or more recycling systems.

Module ENM1100: Conservation Challenge

Students examine relationships between energy and mineral development and the environment, and they propose individual and shared actions that foster environmental stewardship.

Module ENM2010: Managing Alberta's Resources

Students research agencies and structures used to manage the development of Alberta's energy and mineral resources.

Module ENM2020: Conventional Oil/Gas 1 (Resource Exploration)

Students examine specific exploration techniques and technologies within the context of Alberta's conventional oil and/or gas deposits, and they describe related career opportunities.

Module ENM2030: Oil Sands/Heavy Oil/ Coal 1 (Resource Exploration)

Students examine specific exploration techniques and technologies within the context of Alberta's oil sands, heavy oil or coal deposits, and they describe related career opportunities.

Module ENM2040: Metals/Nonmetals 1 (Resource Exploration)

Students examine specific exploration techniques and technologies within the context of a metallic and/or nonmetallic mineral deposit, and they describe related career opportunities.

Module ENM2050: Renewable Energy Technology

Students define and explain the need for sustainable energy development, research one or more renewable energy technologies; e.g., hydro, wind, solar, tidal, biomass, geothermal, nuclear, hydrogen, ethanol, blended fuel, fuel cell, and construct a model of a renewable energy system.

Module ENM2060: Refining Hydrocarbons

Students examine the principles and technologies involved in processing natural gas, refining crude oil, upgrading heavy oils and bitumen, or processing coal. Students also describe related career opportunities.

Module ENM2070: Refining Rocks & Minerals
Students examine the principles and processes involved in refining an industrial (nonmetallic) mineral or a metallic mineral, and they describe related career opportunities.

Module ENM2080: Supply & Distribution
Students research marketing and distribution networks within an energy or mineral industry; examine regulatory structures and policies that influence supply of a commodity, product or service; and describe related career opportunities.

Module ENM2090: Energy Designs/Systems 1 (Basic Principles)
Students investigate the basic principles of energy conservation and efficiency and relate them to energy designs and systems used in the residential, commercial or transportation sector.

Module ENM2100: Environmental Safety
Students identify environmental hazards that result from activities within an energy or mineral industry, and describe specific environmental monitoring and management practices adopted by the industry.

Module ENM3010: Energy & the Environment
Students assess the social, economic and environmental benefits and costs of resource development, and demonstrate personal and shared actions that foster energy conservation and environmental stewardship.

Module ENM3020: Conventional Oil/Gas 2 (Recovery & Production)
Students examine specific recovery and production techniques within the context of a conventional oil and/or gas industry, and they explain related career opportunities.

Module ENM3030: Oil Sands/Heavy Oil/ Coal 2 (Recovery & Production)
Students examine specific recovery and production techniques within the context of Alberta's oil sands, heavy oil or coal deposits; and they explain related career opportunities.

Module ENM3040: Metals/Nonmetals 2 (Recovery & Production)
Students examine specific recovery and production techniques within the context of a metallic and/or nonmetallic mineral deposit, and they explain related career opportunities.

Module ENM3050: Sustainable Energy (The Power & Potential)
Students examine opportunities for planning renewable energy development and conserving conventional energy for its ideal use.

Module ENM3060: Petrochemicals
Students investigate the conversion of hydrocarbons into consumer products within a petrochemical industry, and they explain related career opportunities.

Module ENM3070: Industrial Materials (Primary Manufacturing)
Students investigate technologies used to convert petroleum and mineral resources into industrial (stock) materials used in secondary manufacturing processes, and they explain related career opportunities.

Module ENM3080: Market Basics & Trends
Students explain the basic principles involved in marketing an energy or mineral resource, and analyze trends in the development and marketing of energy or mineral products.

Module ENM3090: Energy Designs/Systems 2 (Practical Applications)
Students analyze energy-saving technologies and systems and design a residential/commercial structure or transportation technology that demonstrates the principles of energy conservation and efficiency.

Module ENM3100: Integrated Resource Management (Balancing Needs)
Students develop and present an integrated plan for sustainable resource development that incorporates supply side and demand side resource management.

SECTION C: PLANNING FOR INSTRUCTION

CTS provides increased opportunity for junior and senior high schools to design courses based on the needs and interests of their students and the circumstances within the school and community. Some strands may be appropriately introduced at the junior high school level. Other strands are more appropriately introduced at the senior high school level or to Grade 9 students. Refer to this section for recommendations regarding the Energy and Mines strand, or the *Career & Technology Studies Manual for Administrators, Counsellors and Teachers* for a summary of the recommended grade levels for each strand.

PLANNING FOR CTS

Defining Courses

Schools determine which strands and modules will be offered in a particular school, and will combine modules into courses.

Each module was designed for approximately 25 hours of instruction. However, this time frame is only a guideline to facilitate planning. The CTS curricula are competency based, and the student may take more or less time to gain the designated competencies within each module.

A course will usually consist of modules primarily from the same strand but, where appropriate, may include modules from other CTS strands. Refer to the *Career & Technology Studies Manual for Administrators, Counsellors and Teachers* (Appendix 4) for more information on course names and course codes.

Module selection and sequencing should consider:

- prerequisite(s)
- supporting module(s) (other CTS modules that may enhance the learning opportunity if offered with the module)
- module parameters
  - instructional qualifications, if specialized
  - equipment and facility requirements, if specialized.

The module parameters are defined for each module in Sections D, E and F of this Guide.

Degree of Flexibility

The CTS program, while designed using the modular structure to facilitate flexible timetabling and instructional delivery, does not mandate the degree of flexibility a school or teacher will offer. The teacher and school will determine the degree of flexibility available to the student. Within the instructional plan established by the school, the student may:

- be given the opportunity to progress at a rate that is personally challenging
- have increased opportunity to select modules that develop competencies he or she finds most relevant.

Integrating Basic Competencies

The basic competencies relate to managing learning and resources, problem solving and innovation, communicating effectively, working with others and demonstrating responsibility are developed throughout the CTS program, and are within each module.

Assessment of student achievement on the basic competencies is integrated throughout the other module learner expectations. Refer to Section G (Assessment Tools) of this Guide for the description of student behaviours expected at each of the four developmental stages defined for the basic competencies.

Assessment of basic competencies could include input and reflection involving the student, teacher(s), peers and others. Description of the observed behaviour could be provided through a competency profile for the module. Positive, ongoing interaction between the student and teacher will support motivation for student growth and improvement.

The basic competencies related to teamwork, service, safety and accountability should be emphasized in Energy and Mines modules at the intermediate and advanced levels where industry-based activities and projects would be appropriate.

Assessing Student Achievement

Assessing student achievement is a process of gathering information by way of observations of process, product and student interaction.

Where appropriate, assessment tools have been defined to assist the teacher and student in the assessment. Refer to Section G (Assessment Tools) of this Guide for copies of the various tools (worksheets, checklists, sample questions, etc.).

A suggested emphasis for each module learner expectation has also been established. The suggested emphasis provides a guideline to help teachers determine time allocation and/or the appropriate emphasis for each MLE and student grade.

Recognizing Student Achievement

At the high school level, successful demonstration of the exit-level competencies in a module qualifies the student for one credit. Refer to Section A of this Guide for more detailed information about how curriculum and assessment standards are defined in CTS. Refer to the *Career & Technology Studies Manual for Administrators, Counsellors and Teachers* (Appendix 12) for more information on how student achievement can be recognized and reported at the school and provincial levels.

Portfolios

When planning for instruction and assessment, consider a portfolio as an excellent tool to provide evidence of a student's effort, progress and achievement. Portfolios will aid students in identifying skills and interest. They also provide the receiving teacher, employer and/or post-secondary institution proof of a student's accomplishments. The make-up and evaluation of the portfolio should be a collaboratively agreement between the student and teacher.

Resources

A comprehensive resource base, including print, software and audio-visual, has been identified to support CTS strands. It is intended that these resources form the basis of a resource centre, encouraging teachers and students to access a wide selection of resources and other information sources throughout the learning process. Unless otherwise noted, these resources are considered to be suitable for both junior and senior high school students.

Authorized resources may be obtained from the Learning Resources Distributing Centre or directly from the publisher or distributor. Refer to Section I (Learning Resource Guide) for the complete resource list including curriculum correlations and resource annotations. Additional sources refer to noncommercial or government agencies that offer resources that may be of assistance in this strand.

Sample Student Learning Guides

In addition to the resources, Sample Student Learning Guides are available (refer to Section J of this Guide). These samples, designed for individual student or small group use, provide an instructional plan for selected modules and include the following components:

- Why take this module?
- What are the entry-level competencies?
- What are the exit-level competencies?
- What resources may be accessed?
- What assignments/activities must be completed?
- What are the timelines?
- How will the final mark be calculated?

Sample Student Learning Guides have been developed for the following modules in Energy and Mines:

- Renewable Resources
- Conservation Challenge.

PLANNING FOR ENERGY AND MINES

The following suggestions are provided to assist teachers and school and school system administrators as they plan to deliver modules from the Energy and Mines strand.

Selecting Modules

The scope and sequence chart in Section B provides an overview of the Energy and Mines modules, indicating prerequisites and theme areas. Brief descriptions of the modules follow the scope and sequence chart in Section B.

Course planning should take into consideration module sequences that link with both physical and human resources present in the school and community. Although not required, it is recommended that ENM1010: Overview of Alberta Geology be a prerequisite/corequisite to all modules in the Energy and Mines strand.

Energy and Mines in Junior High

The introductory level modules may be offered at the junior high level. As each school and community will vary in terms of available resources, it is important to consider potential education partners prior to selecting module sequences.

The number of modules will vary according to time available throughout Grades 7, 8 and 9. For example:

Time Available	Modules
25 hours	**Overview of Alberta Geology**
50 hours	**Overview of Alberta Geology** **Conservation Challenge**
75–100 hours	*add one or two of the following:* **Nonrenewable Resources** **Renewable Resources** **Consumer Products & Services** **Fundamentals of Recycling**

Modules may be combined into courses and offered within a school year or over a span of a few years. Junior high students may not complete all the learner expectations in all the modules.

Where appropriate, junior high school students may also take intermediate level modules, particularly in the Technology and Applications theme.

Energy and Mines in Senior High

All introductory, intermediate and advanced level modules may be offered to senior high students. Some sample courses, based on intermediate and advanced level modules and designed to be delivered to senior high school students, are outlined below.

Time Available	Modules
5 credits (no previous strand experience) with a focus on conventional energy/mineral development	**Overview of Alberta Geology** **Nonrenewable Resources** **Conventional Oil/Gas 1 & 2** **(or Metals/Nonmetals 1 & 2)** **Supply & Distribution**
3 credits (strong background from junior high school) with a focus on renewable energy development	**Renewable Energy Technology** **Sustainable Energy** **Energy Designs/Systems 1**
5–10 credits (foundation for workplace entry in technical/support positions involving exploration, recovery and production)	**Overview of Alberta Geology** **Managing Alberta Resources** **Environmental Safety** **Supply & Distribution** *(and modules selected from the Technology and Applications theme)*
5–10 credits (foundation for entry into post-secondary programs in environmental management)	**Managing Alberta Resources** **Environmental Safety** **Energy & the Environment** **Energy Designs/Systems 1 & 2** **Integrated Resource Management** *(and modules selected from the Technology and Applications theme)*

Modules could also be grouped into comprehensive courses that develop competencies relevant to career opportunities within a specific industry.

Organizing for Learning

A "learn by doing" approach is recommended for the Energy and Mines strand. Essentially, the teacher's role becomes that of guide and partner in the learning process. The "learn by doing" approach requires the teacher to be facilitator and coach, rather than subject-based expert, as students actively participate in learning by doing and discovering.

Small group instruction is a good way to foster learning by doing and discovering. Small groups enable students to be active participants in learning, and develop independent and responsible learning habits. As students work in small group situations they will share information, solve problems, develop consensus and help each other learn content and processes.

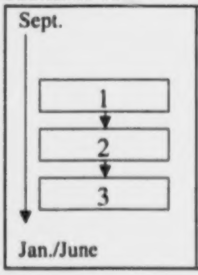
The community has a key role in education and can be an effective partner in the learning process. The use of community members and resources should be integrated into course planning. Business, industry, post-secondary and government agencies offer a wide range of services and resources, as do local clubs, service groups and institutions. When planning for the use of community resources, teachers should ensure that related presentations and/or activities:

- are consistent with student knowledge and skill levels
- demonstrate sound pedagogy
- are exemplary of approved health and safety standards
- provide a balanced approach to curriculum topics and related issues.

Before selecting modules, teachers should check the module parameters outlined in each module (see Sections D, E and F of this Guide).

Modules can be delivered sequentially, concurrently or combined. For example, although the modules from the Technology and Applications theme are sequential, they can be combined with modules from the Social and Cultural Perspectives theme or the Management and Conservation theme.

Scenario A



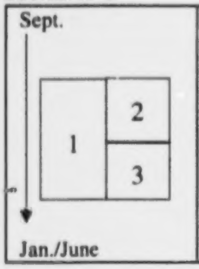
Modules may be taught sequentially, e.g.:

Conventional Oil/Gas 1

↓

Conventional Oil/Gas 2

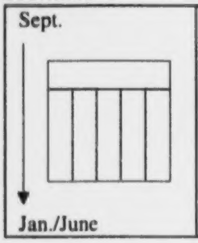
Scenario B



One module, such as Environmental Safety, may be taught throughout the course (e.g., 20 minutes per class) in conjunction with two other modules.

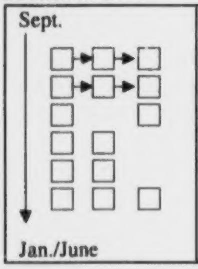
Teachers can also allow students to progress at a rate that is personally challenging; e.g.:

Scenario C



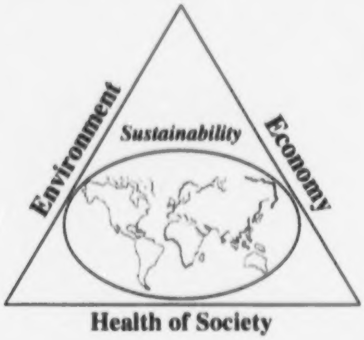
All students take one or two modules together, then are able to select modules from a menu of modules.

Scenario D



From a list of modules defined by the teacher, the students select which ones they will work on and, in consultation with the teacher, establish timelines for completion and submission of assignments, etc.

Plans for learning must address social, environmental and economic perspectives related to sustainable resource development and provide opportunities for students to become involved in learning experiences that reflect a broad understanding of related issues and alternatives. Presentations of course content that reflect a singular or narrow view of social, economic or environmental concerns are not consistent with learner expectations and must be avoided.



As in all CTS strands, students will identify, explore and prepare for future career opportunities. It is recommended that course planning include the integration of relevant career investigations throughout each module, rather than as a singular or isolated study. Career profiles, interviews and job shadowing will acquaint students with the many technical and professional careers associated with the energy and mineral industries.

Instructional Qualifications

Responsibility for instructional planning and assessment of courses in Energy and Mines will be assumed by Alberta certified teachers. A background in science, social studies and/or relevant industry (e.g., resource exploration, recovery or production) will be an asset to those who provide instruction in Energy and Mines modules, particularly at the intermediate and advanced levels. Teachers may find it desirable to access sources of instructional support available from industry, professional associations and consultants, and relevant government agencies (e.g., Alberta Energy).

To ensure compliance with safety and industry standards, some modules may recommend that components of instruction be provided by person(s) having additional credentials granted by business, industry, government or community organizations. Refer to Section D, E or F of this Guide for further information regarding additional instructor qualifications for modules in Energy and Mines.

In some instances it may be desirable to have other qualified individuals in the community work with the teacher to deliver modules (or parts thereof) where additional instructor qualifications are recommended.

Sensitive Issues

Some Energy and Mines modules contain topics of a sensitive nature. Teachers will need to be respectful of family and community values in selecting appropriate modules for courses in Energy and Mines.

For example, issues regarding the role of renewable and nonrenewable resources in sustainable energy development (e.g., ENM3050, ENM3100) may be sensitive in some communities. Emphasis should be placed on a "process" for conflict analysis and not on particular positions that may be expressed. In addition, modules that focus attention on personal and shared actions for environmental stewardship (e.g., ENM1100, ENM3010) must be dealt with in a sensitive manner.

For further clarification of provincial policy on sensitive issues, refer to Alberta Education's Policy on Controversial Issues (*Alberta Education Policy Manual*, 1996). Teachers and administrators should also review jurisdictional policies related to sensitive issues.

Health, Safety and Related Legislation

Facilities used to support an Energy and Mines program must ensure a safe learning/working environment. Students must be aware of federal, provincial and local regulations governing the tasks they perform, and establish appropriate personal and environmental health and safety procedures in modules that involve:

- the use of specialized hand/power equipment
- the handling and storage of hazardous materials
- outdoor trips and field-based investigation.

Students must understand immediate and potential hazards associated with the tasks they perform, and the possible impact of these hazards on self, others and the environment.

Of particular significance from the perspective of health and safety are modules that support the development of technical knowledge and skills relevant to resource exploration, recovery, production and processing (e.g., ENM1020, ENM1060, ENM2020, ENM2030, ENM2040, ENM2050, ENM2060, ENM2070, ENM3020, ENM3030, ENM3040, ENM3050, ENM3060, ENM3070). Practical components of these modules may be delivered through off-campus education. Consultation with the worksite supervisor will be necessary to ensure relevant health and safety standards are maintained.

For additional information on health and safety standards, refer to the *Career & Technology Studies Manual for Administrators, Counsellors and Teachers* (Appendix 13) and the *Off-Campus Education Guide for Administrators, Counsellors and Teachers* (Alberta Education).

Addressing Safety in Off-Campus Excursions

Outdoor trips and field-based investigations are recommended and should be an important part of teaching and learning throughout the Energy and Mines strand. Safety must be a prime consideration in planning off-campus learning experiences. Both teachers and students should engage in activities commensurate with their level of training and ability. Adequate instructional support, guidance and supervision must be provided at all times. Local jurisdiction and school policies must be understood by principals, teachers, parents, supervisors and students.

Preparation and Risk Anticipation

The preparation stage is an important part of any off-campus learning experience. At this stage of planning, potential risks can be anticipated and either avoided or moderated. The preparation stage should focus attention on:

- trip administration, including the use of parental permission forms, health information forms, school/system authorization forms and accident report forms as required
- a review of laws and regulations relevant to the learning site and activities that will be undertaken
- assessment of the learning site in terms of potential hazards and risks that may be present
- group size and the level of supervision that will be required (i.e., supervisor/student ratio)
- a briefing of parents, school administrators, government/industry authorities or others who should be informed regarding itineraries, participants and emergency response plans
- pre-trip logistics, including transportation, equipment, facility and departure date/time considerations
- student preparation, including the development of background knowledge/experience and training in specific skill areas.

On-Site Risk Management

Safety and risk management involves exercising situation-specific judgement throughout the course of off-campus learning. Judgement is the product of experience, and may include recognizing factors such as dangers imposed by equipment, a decline in physical strength, or a more challenging task. Many of the hazard recognition skills can be taught in the classroom in the preparation stage.

A significant aspect of on-site risk management is group management. Teachers can exercise appropriate group management strategies by focusing attention on:

- pacing, including speed of travel, rest stops, distance travelled and fitness level of students
- maintaining a safe distance for observations

- group control, including position of leader, signal systems and buddy systems
- the establishment of group rules and norms
- clearly defined task allocations for each student
- objective hazard recognition in the field, including machinery and equipment, terrain, flora and fauna
- subjective hazard recognition in the field, including level of group energy and level of cooperation.

Emergency Response

If students have been well prepared for field-based learning experiences and appropriate group management strategies exercised, the teacher will have maximized opportunities for effective response to an emergency situation. An effective emergency response action plan should include consideration of:

- a suitable approach to the accident site
- first-aid supplies and techniques
- a strategy for signalling assistance
- an evacuation plan
- group management throughout the emergency situation.

Identifying Linkages

Section H of this Guide describes linkages within CTS and with core and complementary programs.

In particular, teachers should be aware of the linkages of Energy and Mines with the junior and senior high science programs, and with environmental components in the junior high Environmental and Outdoor Education Program. The Energy and Mines strand is designed to reinforce, extend and apply related learnings in these courses. Collaborative planning at the school level will ensure meaningful learning experiences through effective integration of these courses.

The Career Transitions strand of CTS provides project, practicum, safety and leadership modules that may be combined with modules in Energy and Mines to increase opportunity for students to develop expertise, refine their competencies and/or obtain credentials.

Using "Project" Modules

Students may use one or more of the 10 project modules to expand learning beyond the competencies outlined in particular Energy and Mines modules. For example, a study of conventional oil and gas production may require more than the 25, 50 or 75 hours available through modules by that name. In these instances, project modules from the Career Transitions strand may be accessed so as to provide sufficient time for completion of learning and the task. For each project module, the teacher and student establish specific learning outcomes, assessment criteria, resources and timelines.

Using "Practicum" Modules

Students may use one or more of the four practicum modules to extend the competencies developed in particular Energy and Mines module(s) in order to attain a recognized credential offered by an agency external to the school. For example, students who plan to work in the petroleum industry may wish to access practicum modules from the Career Transitions strand in order to obtain a "Hydrogen Sulphide Alive" certificate. Practicum modules must be supervised by both a qualified teacher and an experienced professional authorized to supervise trainees for the credential.

Project and practicum modules are **not** designed to be offered as distinct courses and should **not** be used to extend Work Experience 15, 25 and 35 courses.

Improving Smooth Transitions to the Workplace and/or Post-secondary Programs

Refer to Section H of this Guide for potential transitions students may make into:

- the workplace
- related post-secondary programs or other avenues for further learning.

MODULE CURRICULUM AND ASSESSMENT STANDARDS:

SECTION D: INTRODUCTORY LEVEL

The following pages define the curriculum and assessment standards for the introductory level of Energy and Mines.

Introductory level modules help students build daily living skills and form the basis for further learning. Introductory modules are developed for students who have no previous experience in the strand.

Module learner expectations define the competencies a student must demonstrate to achieve success in a module. Assessment standards define the criteria and conditions to be used for assessing the competencies defined in the module learner expectations.

Specific learner expectations provide a detailed framework for instruction to help students build the competencies defined in the module learner expectations. Additional information and suggestions for instruction are provided in the Notes column; teachers may wish to use this space to record their ideas for instruction or student projects.

Module ENM1010: Overview of Alberta Geology D.3
Module ENM1020: Nonrenewable Resources D.9
Module ENM1050: Renewable Resources D.15
Module ENM1060: Consumer Products & Services D.21
Module ENM1090: Fundamentals of Recycling D.27
Module ENM1100: Conservation Challenge D.33

MODULE ENM1010: OVERVIEW OF ALBERTA GEOLOGY

Level:	Introductory
Theme:	Social and Cultural Perspectives
Prerequisite:	None
Module Description:	Students describe the nature and origin of Alberta's energy and mineral resources, explain their significance in society, and identify related career opportunities.
Module Parameters:	Access to geological maps available from relevant government agencies and professional associations (e.g., Natural Resources Canada, Alberta Geological Survey, Alberta Energy Utilities Board). Access to samples of hydrocarbon bearing rocks and/or minerals available from local industry. Access to a science laboratory, an outdoor geological site where earth layers are exposed (e.g., river bank, recovery site) and a museum of natural history (e.g., Tyrrell Museum).

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • describe the nature and origin of Alberta's energy and mineral resources within the North American geological context	*Assessment of student achievement should be based on:* • a geological time chart for North America that illustrates: – relative geological eras and time – major atmospheric and life events. *Assessment Tool* *Assessment Criteria: Geological Time Charts, ENM1010–1* *Standard* *Complete time chart to a standard of 1 on the rating scale*	50

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Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:* • constructing drawings/models that depict: – the formation and current topography of the western sedimentary basin in relation to Alberta – vertical cross-sections of northeastern, central and southern Alberta, each showing hydrocarbon-bearing formations, mineral deposits and surface resources. *Assessment Tool* *Assessment Criteria: Diagrams and Technical Drawings, ENMDRA* Our Petroleum Challenge, Into the 21st Century *(pp. 26–27)* *Standard* *Complete drawings/models to a standard of 1 on the rating scale* • identifying and mapping: – four nonrenewable sources of energy in Alberta – six metallic and/or nonmetallic minerals found in Alberta. *Assessment Tool* *Task Checklist for Mapping, ENMMAP* *Standard* *Complete mapping activities to a standard of 1 on the rating scale* • conducting laboratory and/or field-based investigations that determine: – physical characteristics of three hydrocarbon-bearing rocks and six metallic/industrial minerals – porosity and permeability of hydrocarbon-bearing rock structures. *Assessment Tool* *Lab Investigations: Rock Structures, ENM1010–2* *Standard* *Perform investigations to a standard of 1 on the rating scale*	

MODULE ENM1010: OVERVIEW OF ALBERTA GEOLOGY (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• explain the social, economic and environmental significance of energy and mineral resources in Alberta	• given current news articles on two energy and/or mineral developments, an analysis of the impacts of each development on the environment and people who live there. *Assessment Tool* *Issue Analysis: Impacts of Energy/Mineral Development, ENM1010–3* *Standard* *Analyze the impacts of two energy/mineral developments to a standard of 1 on the rating scale* • given a specific energy or mineral resource, a presentation or report that describes: – major uses of the resource within Alberta's residential, commercial, industrial and transportation sectors – how development of the resource has affected social/cultural values, historical development/ settlement and economic viability within a region of Alberta. *Assessment Tool* *Presentations/Reports: Introductory Level, ENMPRE–1* *Standard* *Achieve a minimum rating of 1 on the rating scale for Presentations/Reports*	30
• identify career opportunities relevant to the field of geology	• given current resources on career opportunities within the field of geology, completing a research project on one or more related careers. *Assessment Tool* *Career Search: Introductory Level, ENMCAR–1* *Standard* *Conduct research to a standard of 1 on the rating scale*	20
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

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MODULE ENM1010: OVERVIEW OF ALBERTA GEOLOGY (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Alberta's Energy and Mineral Resources	• define and compare renewable and nonrenewable energy resources	Contact Natural Resources Canada and request its map (produced annually) of energy and mineral developments in Canada.
	• describe and locate on a map known reserves of nonrenewable energy resources in Alberta; e.g.: – oil – natural gas – coal – nuclear fuels	Request the *Mineral Deposits and Occurrences in Alberta* map available from Alberta Geological Survey.
	• describe and locate on a map the major types of minerals found in Alberta; e.g.: – metallic – nonmetallic	For example, gold, iron, sulphur, peat, quartz, salts, sodium sulphates, limestone, sand and gravel.
	• identify and describe the physical characteristics of basic hydrocarbon bearing rocks; e.g.: – dolomite – limestone – sandstone – shale	Collect, identify and display rock and mineral samples.
	• identify and describe the physical characteristics of metallic and nonmetallic minerals; e.g.: – coal – copper – iron – limestone – magnesium – sulphur	
	• draw or construct a historical account of the western sedimentary basin that explains Alberta's current topographical features	The historical account can encompass topography prior to the formation of the Rocky Mountains, and also present land features established as a result of the last ice age.
	• draw or construct a vertical cross-section of any part of Alberta showing the location of hydrocarbon-bearing formations, mineral deposits and surface resources.	

MODULE ENM1010: OVERVIEW OF ALBERTA GEOLOGY (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Economic, Environmental and Social Significance	• identify and describe major energy and mineral use sectors in society; e.g.: – residential – commercial – industrial – transportation	Consider applications of: • renewable and nonrenewable energy • metallic, nonmetallic and structural materials. Conduct a personal inventory of energy and mineral use.
	• explain how the energy and mineral industries influence the local and national economy	Discuss trends in energy/mineral markets, and competition from raw material substitutes.
	• describe the flow of energy and mineral resources between Canada and other nations; e.g.: – import partners – export partners	Research Canada's contribution to the world energy supply. Obtain the *Canadian Minerals Yearbook* (available from Natural Resources Canada).
	• identify and describe environmental issues associated with the development of Alberta's energy and mineral resources.	Consider the impact of energy/mineral industries on material and conservation goals, and other quality of life factors.
Career Opportunities	• research career opportunities and the range of occupational opportunities within the field of geology; e.g.: – professional – technical – labour-based	Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development). See the National Occupational Classification System (NOC) in Section H: Linkages/Transitions.
	• gather employment statistics within one or more employment sectors; e.g.: – types of careers – number of workers – employment trends	Plan for individual/group research and presentations. Arrange/facilitate: • information interviews • work study/work experience • job shadowing.
	• predict career opportunities and trends from employment statistics.	Make predictions about energy/mineral industries in the future, and resulting careers.

MODULE ENM1020: NONRENEWABLE RESOURCES

Level:	Introductory
Theme:	Technology and Applications
Prerequisite:	None
Module Description:	Students examine general applications of exploration, recovery and production, refining, and reclamation technologies within a nonrenewable energy or mineral industry; and they identify related career opportunities. Potential areas of investigation include conventional crude oil, oil sands, natural gas, coal, nuclear fuels, metallic minerals, nonmetallic minerals and structural materials.

Module Parameters: Access to a science laboratory and a local energy/mineral industry.

Access to resource maps available from government agencies and professional associations (e.g., Natural Resources Canada, Alberta Geological Survey, Alberta Energy Utilities Board).

Access to community-based interpretive centres/museums (e.g., Energeum, Fort McMurray Oil Sands Interpretive Centre).

Off-campus learning may support the development of knowledge and skills in exploration, production, refining and/or reclamation practices; consultation with the work-site supervisor will ensure that relevant safety considerations are addressed.

See the *Off-Campus Education Guide for Administrators, Counsellors and Teachers* (Alberta Education) for further information regarding off-campus learning.

Supporting Module: CTR1210 Personal Safety (Management) [Career Transitions Strand]; recommended for off-campus learning

Note: Students must have a general knowledge of potential hazards and accepted safety practices relevant to specific exploration, recovery, refining and/or reclamation sites prior to engaging in off-campus learning experiences. See Planning for Instruction in Section C for further information regarding student safety.

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Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **describe the formation and development of a nonrenewable energy or mineral resource in Alberta**	• a presentation or report (written, oral or multimedia) on the formation and development of a nonrenewable energy or mineral resource. Report to include: – a map outlining distribution of the resource throughout Alberta – drawings, models and/or flow charts that depict basic geological processes and structures responsible for the formation of the resource – a list of 25 or more products and/or services derived from the resource – a timeline that outlines major social, economic and environmental factors/events affecting development of the resource in Alberta. *Assessment Tool* *Presentations/Reports: Introductory Level, ENMPRE–1* *Task Checklist for Mapping, ENMMAP* *Assessment Criteria: Diagrams and Technical Drawings, ENMDRA* *Assessment Criteria: Flow Charts, ENMFLO* *Standard* *Achieve a minimum rating of 1 on the rating scale for Presentations/Reports and related mapping/drawing/charting activities*	40
• **explain basic exploration, recovery and production, refining, and reclamation practices within a nonrenewable energy or mineral industry**	• flow charts that illustrate basic stages and steps in resource exploration, recovery and production, refining and reclamation for a nonrenewable energy or mineral resource. *Assessment Tool* *Assessment Criteria: Flow Charts, ENMFLO* *Standard* *Complete flow charts to a standard of 1 on the rating scale*	50

MODULE ENM1020: NONRENEWABLE RESOURCES (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
	• through laboratory and/or field-based investigations, identifying principles of science and technology used in at least one area of industry exploration, production, refining or reclamation. *Assessment Tool* *Lab Investigations: Introductory Level, ENMLAB–1* *Observation Checklist for Field-based Investigations, ENMOBS* *Standard* *Conduct lab investigations to a standard of 1 on the rating scale and/or complete all sections of the observation checklist for field-based investigations*	
• **identify career opportunities relevant to a nonrenewable energy or mineral industry**	• given current resources on career opportunities in a nonrenewable energy or mineral sector, completing a research project on one or more related careers. *Assessment Tool* *Career Search: Introductory Level, ENMCAR–1* *Standard* *Conduct research to a standard of 1 on the rating scale*	10
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

MODULE ENM1020: NONRENEWABLE RESOURCES (continued)

Concept	Specific Learner Expectations	Notes
History, Formation and Use	*The student should:* • describe major historical events in the development of a nonrenewable energy or mineral resource in Alberta; e.g.: – logistics of exploration – problems/issues in development – boom and bust cycles – technological advances • show the resource on a map of Alberta • describe basic geological processes and structures responsible for resource formation • identify and describe products and by-products derived from the resource; e.g.: – fuel – nonfuel • explain how the resource has influenced both the people and the economy of Alberta; e.g.: – economic benefits – material products and services – employment • identify environmental issues resulting from the use of nonrenewable resources; e.g.: – greenhouse gases – acid deposition – resource depletion • research forecasts regarding future resource supply and demand, and options for ensuring a sustainable future; e.g.: – using less – finding alternative sources.	Discuss social, economic and environmental issues affecting resource development. Focus attention on: • concept of geologic time • rock and mineral formation • important elements of Alberta geography • theory of plate tectonics. Products and by-products may include: • space and water heating • heat for industrial purposes • fuels for transportation • electricity • petrochemicals • metallic/nonmetallic materials. Discuss resource ownership/royalties and subsequent benefits to society. Involve students in high interest research activities; e.g.: • gold panning/sluicing • rock/mineral collecting • potential cottage industry.
Nonrenewable Resource Technology	• describe basic exploration techniques used within a nonrenewable energy or mineral industry in Alberta; e.g.: – topographical features – drilling techniques – seismic operations	Plan field trips into the community. Involve knowledgeable persons from local business and industry.

Concept	Specific Learner Expectations	Notes
Nonrenewable Resource Technology (continued)	*The student should:* • describe basic recovery and production technologies used within the industry; e.g.: – service rigs – chemical processes – strip mining • describe basic refining and manufacturing techniques used within the industry; e.g.: – cracking and fractionating – smelting and milling • describe basic reclamation technologies used within the industry; e.g.: – exploration/process area restoration – strip mine restoration.	Describe current techniques used to prevent/minimize environmental impact: • H_2S gathering and storage • cooling pits for waste water • liners for storage tanks. Identify strategies used to recover a nonrenewable resource in the most effective, efficient and beneficial manner.
Career Opportunities	• research career opportunities associated with the development of a nonrenewable energy or mineral resource; e.g.: – resource exploration – recovery and production – refining and manufacturing – reclamation • interpret employment statistics within one or more employment sectors; e.g.: – type of careers – number of workers – employment trends • predict career opportunities and trends from employment statistics • research education and training requirements for employment within one or more career areas.	Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development). See the National Occupational Classification System (NOC) in Section H: Linkages/Transitions. Invite local business/ industry representatives to explain: • the human resource/ personnel structure of a resource company • service departments and related occupations. Predict future industry trends and career opportunities Assess current employment opportunities in a chosen field. Arrange/facilitate: • information interviews • work study/work experience • job shadowing.

MODULE ENM1050: RENEWABLE RESOURCES

Level: Introductory

Theme: Technology and Applications

Prerequisite: None

Module Description: Students demonstrate applications of one or more renewable energy technologies, examine the contributions of each to sustainable energy development, and identify related career opportunities. Potential areas of investigation include solar, hydro, wind, tidal, biomass and geothermal energy, as well as energy generated from waste.

Module Parameters: Access to relevant government, industry and community resources (e.g., Alberta Energy, Alberta Environmental Protection, Energy Efficiency Association of Alberta, Pincher Creek Development and Information Centre, Biomass Energy Institute, Canadian Wind Energy Association, Solar Energy Society of Canada, Small Power Producers Association of Alberta).

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • describe applications of renewable energy technology	*Assessment of student achievement should be based on:* • identifying and mapping sources of renewable energy on a map of Alberta. *Assessment Tool* *Task Checklist for Mapping, ENMMAP* *Standard* *Complete mapping activities to a standard of 1 on the rating scale* • given a specific energy need, constructing a drawing/model of a renewable energy system to meet that need. The drawing/model must address: – component parts and principles of operation – efficient use of resources – human and environmental safety. *Assessment Tool* *Project Assessment: Technology Design, ENMTEC* *Assessment Criteria: Diagrams and Technical Drawings, ENMDRA* *Standard* *Complete the design and drawing/model to a standard of 1 on the rating scale*	60

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MODULE ENM1050: RENEWABLE RESOURCES (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
	• a concept test in which the student demonstrates knowledge of renewable energy resources and systems currently used in Alberta. Test items to address the use of hydroelectric, solar, hydro, wind, tidal, biomass and geothermal energy, and energy generated from waste. *Assessment Tool* Energy Sources/Applications/Alternatives *(Instructor's Manual)* *Standard* *Response indicating 60% mastery*	
• explain current and potential contributions of renewable energy to sustainable energy development	• a presentation or report on basic principles of sustainable energy development. Report to address: – definitions and examples of sustainable energy development – benefits and difficulties related to the use of renewable and nonrenewable energy – the role of alternative energy options, energy efficiency and conservation lifestyles in achieving sustainable energy development – a comparison of sustainable energy development in Alberta and another part of the world. *Assessment Tool* *Presentations/Reports: Introductory Level, ENMPRE–1* *Standard* *Achieve a minimum rating of 1 on the rating scale for Presentations/Reports*	30

MODULE ENM1050: RENEWABLE RESOURCES (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
	• given a current issue regarding use of a renewable and/or nonrenewable energy technology: – identifying social, economic and environmental perspectives relevant to the issue – developing a plan for dealing with the issue that furthers sustainable energy supply. *Assessment Tool* *Issue Analysis: Sustainable Energy Development, ENM1050–1* *Standard* *Analyze the issue and develop a plan for dealing with the issue to a standard of 1 on the rating scale*	
• **identify career opportunities relevant to renewable energy development**	• completing a research project on one or more career opportunities in renewable energy development. *Assessment Tool* *Career Search: Introductory Level, ENMCAR–1* *Standard* *Conduct research to a standard of 1 on the rating scale*	10
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Renewable Energy Technology	*The student should:* • identify and describe renewable energy sources currently used in Alberta; e.g.: – hydroelectric – solar – wind – biomass – geothermal – energy from waste • show on a map regions of the province that use renewable energy technologies • describe renewable sources of energy not currently used in Alberta • design and/or construct a renewable energy technology • demonstrate one or more applications of renewable energy technology.	Research/debate the statement—"there is no such thing as renewable energy." Which renewable energy sources have the greatest potential for use in Alberta? Why? Compare active and passive solar systems. Explain applications of wind energy: • electricity generation • water pumping. Design, construct and test technologies used to perform specific tasks. Plan and design a community that uses renewable energy as a supplement to energy needs.
Sustainable Energy Development	• define sustainable energy development • compare the role of renewable and nonrenewable energy technologies in sustainable energy development • identify factors that determine the feasibility of renewable energy development; e.g.: – social and economic – geological – technological – environmental • compare and contrast use of renewable energy in Alberta with other parts of the world in supplementing energy supply • assess potential impacts of renewable energy development on the environment.	Explain the meaning of the phrase "soft energy path"; e.g.: • least-cost energy strategy • efficient energy use • sustainable energy path. What factors enable renewable resources to be an effective supplement to energy needs in specific areas of Alberta, Canada and other parts of the world? Conduct research on: • the use of wind energy in Quebec or Minnesota • energy diversification in Europe • the development of remote solar and micro-hydro systems in South America.

MODULE ENM1050: RENEWABLE RESOURCES (continued)

Concept	Specific Learner Expectations	Notes
Career Opportunities	*The student should:* • research career opportunities relevant to renewable energy development; e.g.: – resource exploration – recovery and production – engineering and design – resource management • interpret employment statistics within one or more employment sectors; e.g.: – types of careers – number of workers – employment trends • predict career opportunities and trends from employment statistics • research renewable energy development in the future, and resulting career opportunities.	Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development). See National Occupational Classification System (NOC) in Section H: Linkages/Transitions. Arrange/facilitate: • information interviews/ field visits • work study/work experience • job shadowing. Plan for individual/group research and presentations.

MODULE ENM1060: CONSUMER PRODUCTS & SERVICES

Level:	Introductory
Theme:	Technology and Applications
Prerequisite:	None
Module Description:	Students examine the basic techniques involved in developing consumer products and/or services within an energy or mineral industry, and they identify related career opportunities.
Module Parameters:	Access to a relevant processing, refining, manufacturing or service industry. Off-campus learning may support the development of knowledge and skills in processing, refining and/or manufacturing practices; consultation with the work-site supervisor will ensure that relevant safety considerations are addressed. See the *Off-Campus Education Guide for Administrators, Counsellors and Teachers* (Alberta Education) for further information regarding off-campus learning.
Supporting Module:	CTR1210 Personal Safety (Management) [Career Transitions Strand]; recommended for off-campus learning Students must have a general knowledge of potential hazards and accepted safety practices relevant to specific processing, refining and/or manufacturing sites prior to engaging in off-campus learning experiences. See Planning for Instruction in Section C for further information regarding student safety.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **describe the range of consumer products and services derived from energy and mineral resources**	• a presentation or report (written, oral and/or multimedia) that describes: – three or more consumer products/services derived from each of the following: oil, gas, coal, petrochemicals, metallic minerals, industrial minerals, decorative stone, sand and gravel – applications of renewable and nonrenewable energy in producing electricity and heat energy for domestic and industrial use. *Assessment Tool* *Presentations/Reports: Introductory Level, ENMPRE–1* *Standard* *Achieve a minimum rating of 1 on the rating scale for Presentations/Reports*	40
• **explain the processes used to develop a consumer product or to provide a related service**	• flow charts that illustrate basic stages and steps in developing a consumer product or providing a related service. *Assessment Tool* *Assessment Criteria: Flow Charts, ENMFLO* *Standard* *Complete flow charts to a standard of 1 on the rating scale* • through laboratory and/or field-based investigations, identifying principles of science and technology used in developing an energy or mineral product. *Assessment Tool* *Lab Investigations: Introductory Level, ENMLAB–1* *Observation Checklist for Field-based Investigations, ENMOBS* *Standard* *Conduct lab investigations to a standard of 1 on the rating scale and/or complete all sections of the observation checklist for field investigations*	50

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MODULE ENM1060: CONSUMER PRODUCTS & SERVICES (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• identify career opportunities relevant to an energy or mineral processing, refining or manufacturing industry	• completing a research project on one or more career opportunities within an energy or mineral industry. *Assessment Tool* *Career Search: Introductory Level, ENMCAR–1* *Standard* *Conduct research to a standard of 1 on the rating scale*	10
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Consumer Products and Services	• identify and describe a range of consumer products or services derived from nonrenewable energy resources; e.g.: – oil, gas and coal – oil, gas and coal by-products – petrochemicals • identify and describe a range of consumer products and services derived from mineral resources; e.g.: – metallic and nonmetallic minerals – art and decorative stone – sand and gravel	Prepare tree charts, collages and bulletin board displays. Collect samples of consumer products. Contact Alberta Energy to obtain copies of: • *Alberta's Energy and Mineral Resources* • *Energy in Alberta.* Brochures entitled "Aggregates" and "Aggregates and Our Environment" are available from the Alberta Sand and Gravel Association.

Concept	Specific Learner Expectations	Notes
	The student should:	
Consumer Products and Services (continued)	• explain the role of renewable and nonrenewable energy resources in producing electricity and heat energy; e.g.: – space and water heating – heat for industrial processing – fuels for transportation	Ask resource persons from a local utility company to discuss domestic and industrial applications of electricity and heat energy.
	• given a specific energy or mineral resource, provide reasons for maintaining, increasing or decreasing current production levels	
	• predict factors that may influence energy and mineral industries in the future; e.g.: – alternative energy sources – material substitutes – market competition and change.	Keep a journal of media articles relevant to recent developments in the energy or mineral industries.
Product Development	• identify and describe the basic steps involved in developing a consumer product or providing a related service; e.g.: – resource exploration – recovery and production – processing/refining	Prepare flow charts/ diagrams. Plan visits to local industry. Ask resource persons from local industry to explain steps involved in product development.
	• describe industry strategies for ensuring the quality of the product or service; e.g.: – quality indicators – control measures – regulation and legislation	Consider related health issues.
	• identify methods used to transport, store and market the product or service	Identify determinants of regional commodity processing.
	• describe reclamation needs and practices within the industry; e.g.: – land restoration – water and soil treatments	Research the impacts of energy/mineral development on environmental factors.
	• describe facilities and equipment essential to developing the product or service; e.g.: – design features – operation and maintenance – safety.	

MODULE ENM1060: CONSUMER PRODUCTS & SERVICES (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Career Opportunities	• research career opportunities within an energy or mineral processing, refining or manufacturing industry; e.g.: – processing and refining – manufacturing – reclamation – transportation – marketing	Plan for individual/group research and presentations. Arrange/facilitate: • information interviews • work study / work experience • job shadowing.
	• interpret employment statistics within one or more employment sectors; e.g.: – types of careers – number of workers – employment trends	Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development).
	• predict career opportunities and trends based on employment statistics.	See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.

MODULE ENM1090: FUNDAMENTALS OF RECYCLING

Level: Introductory

Theme: Management and Conservation

Prerequisite: None

Module Description: Students examine opportunities to recycle natural and manufactured materials, and they present the results of research on one or more recycling systems.

Module Parameters: Access to government-, industry- and/or community-sponsored recycling facilities and systems.

Access to a science laboratory.

Off-campus learning may support the development of knowledge and skills in recycling practices; consultation with the work-site supervisor will ensure that relevant safety considerations are addressed.

See the *Off-Campus Education Guide for Administrators, Counsellors and Teachers* (Alberta Education) for further information regarding off-campus learning.

Supporting Module: CTR1210 Personal Safety (Management) [Career Transitions Strand]; recommended for off-campus learning

Students must have a general knowledge of potential hazards and accepted safety practices relevant to specific recycling sites prior to engaging in off-campus learning experiences. See Planning for Instruction in Section C for further information regarding student safety.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • present a rationale for waste reduction through recycling, and describe trade-offs that occur through the recycling process	*Assessment of student achievement should be based on:* • negotiating and debating the benefits and costs (from both economic and environmental perspectives) of recycling an organic or inorganic material (e.g., rubber, plastic, paper, earth product). Negotiation and debate to address: – problems associated with the generation of wastes at local and global levels – both small- and large-scale options for waste reduction through reducing, reusing, recycling and recovering. *Assessment Tool* *Negotiation and Debate: Introductory Level, ENMNEG–1* *Standard* *Address criteria in negotiation/debate to a standard of 1 on the rating scale*	20

MODULE ENM1090: FUNDAMENTALS OF RECYCLING (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	-
• identify opportunities to recycle organic and inorganic materials, and describe the resulting products that may be developed	• identifying and locating recycling facilities and systems currently used in Alberta. *Assessment Tool* *Task Checklist for Mapping, ENMMAP* *Standard* *Identify recycling facilities/systems on a map of Alberta to a standard of 1 on the rating scale* • through laboratory and/or field-based investigations, identifying principles of science and technology used in recycling an organic or inorganic material (e.g., glass, metal, cellulose, petrochemical). *Assessment Tool* *Lab Investigations: Introductory Level, ENMLAB–1* *Observation Checklist for Field-based Investigations, ENMOBS* *Standard* *Conduct lab investigations to a standard of 1 on the rating scale and/or complete all sections of the observation checklist for field-based investigations* • a concept test in which the student demonstrates knowledge of: – recyclable materials (e.g., organic, inorganic) – recycling systems (e.g., cogeneration, methane capture). *Assessment Tool* Energy Sources/Applications/Alternatives *(Instructor's Manual)* *Standard* *Response indicating 60% mastery*	50

MODULE ENM1090: FUNDAMENTALS OF RECYCLING (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
	• planning and implementing a home, school or community project for recycling an organic or inorganic material. *Assessment Tool* *Task Checklist: Planning and Implementing a Recycling Project, ENM1090–1* *Standard* *Plan and implement the recycling project to a standard of 1 on the rating scale*	
• **describe one or more recycling systems**	• completing a research project on one or more recycling systems. *Assessment Tool* *Research Process: Recycling Systems, ENM1090–2* *Standard* *Complete all components of research to a standard of 1 on the rating scale*	30
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Principles of Recycling	• describe societal trends in the consumption of material goods and generation of waste material • research problems and alternatives associated with the disposal of waste materials at local and global levels • explain the four Rs as an environmental hierarchy of options for conserving resources and reducing pollution: – reduce – reuse – recycle – recover	Gather media articles (or use the Internet). Obtain statistics regarding trends in waste generation at local and global levels. Compare and contrast recycling with reusing a familiar product. Discuss "packaging" as the largest component of waste.

MODULE ENM1090: FUNDAMENTALS OF RECYCLING (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Principles of Recycling (continued)	• illustrate how recycling involves taking apart a used product and using the material it contains to make a new product	Identify common examples of recycling in nature.
	• identify potential benefits and costs associated with the recycling of used materials; e.g.: – use of energy and other natural resources – impact on pollution, litter and the environment – cost related to collecting and processing materials	Conduct research on the benefits and costs of a familiar recycling system. Negotiate and debate the trade-offs while assuming the roles of different stakeholder groups.
	• analyze economic and environmental trade-offs that occur through the recycling of a natural or manufactured material (e.g., rubber, plastic, paper, earth product).	Plan and implement a strategy for recycling a waste product.
Opportunities for Recycling	• identify major categories and examples of recyclable materials, and potential products that can be developed from these materials: – organic (e.g., plant material, paper, soil) – inorganic (e.g., glass, metal, petrochemical)	Consider opportunities for recycling household items such as: • glass jars • scrap metal • tin cans • newspapers • motor oil • waste plant material.
	• explain recycling systems that have the potential to reduce energy consumption and/or waste generation; e.g.: – cogeneration – methane capture – use of waste heat	Prepare flow charts/ diagrams of these and other recycling systems.
	• explain that the viability of a recycling system may depend upon the extent to which revenues from the sale of the recycled product or service offset the costs associated with collecting and processing raw materials	Ask a resource person from a local industry to discuss economic factors that impact recycling policies.
	• identify and locate recycling facilities and systems currently used in Alberta	Locate major recycling facilities/systems on a map of Alberta.
	• identify a strategy for personal involvement in the recycling of an organic or inorganic material (e.g., glass, metal, cellulose, petrochemical).	Sample community recycling projects are provided in "Somebody... Should Do Something About This!" (a resource binder available from Alberta Energy).

MODULE ENM1090: FUNDAMENTALS OF RECYCLING (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Recycling Systems	• research the products and/or services provided by an industry involved in recycling	See the research strategies provided in "Focus on Research."
	• describe inputs to processing within the industry; e.g.: – commodity inputs/raw materials – financial resources – human and natural resources – technology	Conduct research on a local recycling industry; e.g.: • Dominion Glass Company (Redcliff) • Papercycle of Alberta (Edmonton) • Ipsco Steel Sales Ltd. (Regina).
	• explain major stages and steps in recycling the waste material; e.g.: – collecting and sorting – processing/product formation – transportation and storage	
	• explain techniques used to control quality within the recycling industry; e.g.: – inspection/sorting of raw materials – product quality and uniformity	Request information on current recycling programs from Alberta Environment (Waste Management Branch).
	• describe transportation and storage requirements, and their impact on industry location and recycling costs	Loan-free films/videos available from the National Film Board of Canada include: • *Waste Not, Want Not: The Recycling Imperative* • *Renewable Society: The Vital Option.*
	• identify environmental standards and concerns that affect the recycling industry; e.g.: – water, soil and air quality – use of energy and other resources	
	• identify and explain current legislation that affects the recycling industry	
	• describe factors that affect the economic viability of recycling; e.g.: – collecting, sorting, processing and transportation costs – potential market for the product or service – relative cost of waste disposal by other means	Explore potential linkages with the Legal Studies strand (e.g., modules on environmental law).
	• compare and contrast the recycling facility with a similar facility operating in another area of Alberta, Canada or the world.	Compare local, national and international approaches to recycling.

MODULE ENM1100: CONSERVATION CHALLENGE

Level: Introductory

Theme: Management and Conservation

Prerequisite: None

Module Description: Students examine relationships between energy and mineral development and the environment, and they propose individual and shared actions that foster environmental stewardship.

Module Parameters: Access to government, industry and community organizations responsible for sustainable energy/mineral development (e.g., Natural Resources Canada, Alberta Energy, Alberta Environmental Protection, Alberta Research Council, Alberta Energy and Utilities Board, Alberta Oil Sands Technology and Research Authority, Petroleum Communication Foundation).

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • describe ways in which energy or mineral development may affect the environment	*Assessment of student achievement should be based on:* • completing a research project on the environmental impacts of an energy or mineral development. Research to address: – land use practices – soil, water and air quality factors – waste/emission control – impact on wildlife and natural habitat – site reclamation practices – compliance with environmental policy. *Assessment Tool* *Research Process: Environmental Impacts, ENM1100–1* *Standard* *Complete all components of research to a standard of 1 on the rating scale*	25

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MODULE ENM1100: CONSERVATION CHALLENGE (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • **identify trends in the consumption of an energy or mineral resource, and explain the objectives of a conservation strategy**	*Assessment of student achievement should be based on:* • graphs constructed to illustrate consumption patterns and trends within each of Alberta's residential, commercial, industrial and transportation sectors. *Assessment Tools* *Assessment Criteria: Graphs, ENMGRA* Alberta in the Global Energy Spectrum, *Alberta Energy Information Centre* Energy Alberta 1996, *Alberta Energy and Utilities Board* *Standard* *Construct each graph to a standard of 1 on the rating scale* • developing and presenting a conservation strategy for an energy or mineral resource. Strategy to address: – definitions and examples of conservation and preservation – a rationale for conservation of the resource – a plan for action, based on reduced consumption, energy alternatives and/or material substitutes – supporting agencies and/or structures. *Assessment Tool* *Assessment Criteria: A Conservation Strategy, ENM1100–2* *Standard* *Develop and present the conservation strategy to a standard of 1 on the rating scale*	25

MODULE ENM1100: CONSERVATION CHALLENGE (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • propose personal and shared actions that foster conservation and responsible use of an energy or mineral resource	***Assessment of student achievement should be based on:*** • maintaining a journal of lifestyle practices that affect an energy or mineral resource, inferences regarding the potential impact of each practice on the resource, and ideas for environmental citizenship. Each journal entry to involve reflection on: – needs versus wants – consumerism – use of leisure time – conservation ethics. *Assessment Tool* *Reflection Guide for Environmental Responsibility/Citizenship, ENMREF* *Guide to Inferences: Personal Impact on Resources, ENM1100–3* *Standard* *Complete 10 journal entries; address criteria for reflection to a standard of 1 on the rating scale* • given a current issue regarding societal use of an energy or mineral resource, negotiating and debating the issue while assuming the role of one or more stakeholder groups. *Assessment Tool* *Negotiation and Debate, ENMNEG–1* *Standard* *Address criteria in negotiation/debate to a standard of 1 on the rating scale* • a proposal (oral, written or visual) that suggests one personal action and one leadership role in relation to resource conservation and environmental citizenship. *Assessment Tool* *Assessment Criteria: Proposal for Environmental Action, ENMPRO* *Standard* *Complete each proposal to a standard of 1 on the rating scale*	50

MODULE ENM1100: CONSERVATION CHALLENGE (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
	• a personal contract expressing commitment to five or more lifestyle practices that foster responsible use of an energy or mineral resource. *Assessment Tools* A Primer on Environmental Citizenship, *Environment Canada* *Sample Conservation Contract, ENM1100–4* *Standard* *Complete all parts of the "Conservation Contract"*	
	• a letter written to a management official expressing support or concern regarding an energy or mineral development, and critique of the response received. *Assessment Tool* *Assessment Criteria: Letters of Support or Concern, ENMLET* *Standard* *Complete the letter to a standard of 1 on the rating scale*	
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Environmental Impact	• identify environmental factors related to the extraction, processing and use of an energy or mineral resource; e.g.: – land use practices – soil, water and air quality – wildlife habitat and natural areas • research and make predictions regarding environmental change at global levels caused by resource development	Discuss the impact of transportation corridors on rural and/or native villages, wildlife and other development projects. For example, • deforestation • acid deposition • greenhouse effect.

MODULE ENM1100: CONSERVATION CHALLENGE (continued)

Concept	Specific Learner Expectations	Notes
Environmental Impact (continued)	*The student should:* • identify short- and long-term benefits and costs related to the extraction, processing and use of an energy or mineral resource • explain strategies that enable an energy or mineral industry to protect the environment; e.g.: – waste/emission control – soil, water and air quality sampling – wildlife/habitat protection – site reclamation – compliance with environmental policy – research and development.	Research an environmental "success story" within an energy or mineral industry.
A Conservation Strategy	• identify demands placed on an energy or mineral resource in Canada and Alberta; e.g.: – residential – commercial – industrial – transportation • explain patterns and trends in consumption and use of the resource • provide justification for conservation of the resource; e.g.: – declining reserves – environmental impact • describe major aspects of conservation in relation to the resource; e.g.: – using less – relying more on alternatives or substitutes • identify specific goals of departments and agencies involved in the conservation of the resource; e.g.: – local – national – international • relate specific energy or mineral conservation practices to the resource saved and subsequent benefits to society.	Consider: • sustainable development • economic diversification/ expansion Compare/contrast philosophies of conservation and preservation. Discuss the benefits of relying more on energy alternatives/material substitutes, and conserving nonrenewable resources for their ideal use and less damage to the environment. Identify and explain current legislation pertinent to the recycling industry.

MODULE ENM1100: CONSERVATION CHALLENGE (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Personal and Shared Actions	• explain how personal attitudes, actions and lifestyles may affect an energy or mineral resource; e.g.: – conservation ethic – energy use practices – housing and transportation choices	Compile a personal inventory of material possessions/daily practices that affect an energy or mineral resource.
	• plan and conduct a school-wide campaign to increase awareness of economic, social and environmental perspectives regarding our use of energy	Distinguish between "needs" and "wants" as reflected through an inventory of consumption.
	• debate an issue regarding the impacts of lifestyle on an energy or mineral resource; e.g.: – conduct research – develop a position – participate in debate	Invite a community member to moderate the debate.
	• propose personal strategies for using an energy or mineral resource which foster the attainment of social, economic and environmental goals; e.g.: – personal actions – leadership roles	Consider: • recycling and reusing • reducing • transportation alternatives.
	• establish consensus regarding a local issue involving the development and/or use of an energy or mineral resource; e.g.: – conduct research – generate alternatives – agree to a workable solution	
	• identify constructive ways in which individuals can influence public decisions that affect an energy or mineral resource; e.g.: – voting – lobbying – seeking office – supporting compatible interest groups.	

MODULE CURRICULUM AND ASSESSMENT STANDARDS:

SECTION E: INTERMEDIATE LEVEL

The following pages define the curriculum and assessment standards for the intermediate level of Energy and Mines.

Intermediate level modules help students build on the competencies developed at the introductory level and focus on developing more complex competencies. They provide a broader perspective, helping students recognize the wide range of related career opportunities available within the strand.

Module ENM2010: Managing Alberta's Resources E.3
Module ENM2020: Conventional Oil/Gas 1 (Resource Exploration) E.9
Module ENM2030: Oil Sands/Heavy Oil/Coal 1 (Resource Exploration) E.15
Module ENM2040: Metals/Nonmetals 1 (Resource Exploration) E.23
Module ENM2050: Renewable Energy Technology E.31
Module ENM2060: Refining Hydrocarbons E.35
Module ENM2070: Refining Rocks & Minerals E.41
Module ENM2080: Supply & Distribution E.47
Module ENM2090: Energy Designs/Systems 1 (Basic Principles) E.53
Module ENM2100: Environmental Safety E.59

MODULE ENM2010: MANAGING ALBERTA'S RESOURCES

Level:	Intermediate
Theme:	Social and Cultural Perspectives
Prerequisite:	None
Module Description:	Students research agencies and structures used to manage the development of Alberta's energy and mineral resources.
Module Parameters:	Access to government agencies responsible for the sustainable management of energy and mineral resources (e.g., Alberta Energy and Utilities Board, Alberta Energy, Environment Canada).

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • **explain how Alberta's energy and mineral resources are managed**	*Assessment of student achievement should be based on:* • completing a research project on the history of energy and mineral development in Alberta. Research to include: – a historical account of changes that have occurred in the ownership and administration of energy and mineral resources in Alberta – an explanation of public (provincial and federal Crown) and private ("freehold") forms of land ownership that exist in Alberta today. *Assessment Tool* *Research Process: Administration of Energy/Mineral Resources, ENM2010–1* *Standard* *Complete all components of research to a standard of 2 on the rating scale*	20

MODULE ENM2010: MANAGING ALBERTA'S RESOURCES (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• describe government legislation and policies that influence the development of an energy or mineral resource	• identifying and explaining the role of: – important government legislation in managing exploration and development activities within one of Alberta's energy or mineral industries – regulations and/or guidelines established in association with government legislation for further managing activities within the industry. *Assessment Tool* *Relevant government legislation, regulations and/or guidelines available from Alberta Energy* *Standard* *Summarize 3 important government legislation and 5 regulations and/or guidelines*	40
• explain methods of allocating land and resources for exploration and development	• a presentation or report on five or more different types of approvals (e.g., permits, licences, leases) used to grant exploration and/or development rights within a selected energy or mineral industry. For each approval, presentation/report to provide information regarding: – the authority granting approval – criteria for granting the approval – the intent of the approval – responsibilities of the holder. *Assessment Tool* *Presentations/Reports: Intermediate Level, ENMPRE–2* *Standard* *Achieve a minimum rating of 2 on the rating scale for Presentations/Reports*	40
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

MODULE ENM2010: MANAGING ALBERTA'S RESOURCES (continued)

Concept	Specific Learner Expectations	Notes
Administration of Energy and Minerals	*The student should:* • describe major changes that have occurred from past to present in the ownership and administration of energy and mineral resources in Alberta; e.g.: – private ownership of mineral rights – federal jurisdiction – provincial status – aboriginal lands and Native rights – *Natural Resources Transfer Act* • describe the extent to which different types of resource ownership exist in Alberta today; e.g.: – public (provincial and federal Crown ownership) – private ("freehold") ownership.	Use archives, films and library resources to research the history of energy or mineral development in Alberta. Construct a timeline of historical changes in administrative policies. Contact Alberta Energy to request maps of land ownership areas in Alberta. Construct graphs depicting land ownership distribution.
Government Legislation and Policies	• explain the mandate and responsibilities of key government departments and agencies in managing energy and mineral resources within provincial boundaries; e.g.: – disposition of mineral rights – regulation of exploration and development – development of conservation practices and environmental standards – collection of fair returns from resource development • explain current and potential opportunities for industry involvement in managing energy and mineral resources within provincial boundaries • research the role of important federal and provincial legislation in managing exploration and development activities within one of Alberta's energy or mineral industries	Research and report on the functions of: • Alberta Energy and Utilities Board • Natural Resources Conservation Board • Alberta Energy • Alberta Environmental Protection. Contact Alberta Energy to request various legislation, regulations and guidelines; e.g.: • *Environmental Protection and Enhancement Act* • *Mines and Mineral Act* • *Public Lands Act* • *Surface Rights Act* • *Fisheries Act* • *Oil and Gas Conservation Act* • *Quarries Regulation Act* • *Small Power Research and Development Act.*

Concept	Specific Learner Expectations	Notes
	The student should:	
Government Legislation and Policies (continued)	• research the role of regulations and guidelines established in association with government legislation in further managing activities within an energy or mineral industry	For example: • *Metallic Minerals Regulation* • *Environmental Impact Assessment Guidelines* • *Environmental Operating Guidelines* • *Waste Water Management Guidelines* • *Sand, Gravel, Clay and Marl Surface Operations Regulations.*
	• evaluate the short- and long-term effects of selected government legislation and regulations on one of Alberta's energy or mineral resources.	Avoid detailed analysis of legislation and regulations – **OVERVIEW ONLY**.
Allocation Procedures	• explain how approvals (in the form of permits, licences, leases and other legal agreements) are used to grant exploration and/or development rights • identify factors that determine the nature of approvals required for a development activity; e.g.: – resource ownership (public or private) – type of resource to be developed	Explain that although the government leases mineral rights to the private sector for development, it collects a fair share of resource rents through royalty payments, development fees and freehold mineral taxes.
	• identify criteria taken into consideration when reviewing development applications and granting project approvals; e.g.: – sustainable development – reclamation of land – environmental protection – market demands and fluctuations – estimated returns and production life – integrated use of land	Prepare a flow chart outlining procedures followed by an industry to obtain project approval.
	• research departments and/or agencies having authority to grant approval for a selected energy or mineral development project	For example: • Alberta Energy and Utilities Board • Alberta Environmental Protection • Alberta Energy • Environment Canada.

Concept	Specific Learner Expectations	Notes
	The student should:	
Allocation Procedures (continued)	• research the intent of different permits, licences and/or agreements required prior to commencing the development project	For example: • Surface Rights Leases/Agreements • Exploration Approvals/Licences • Development and Reclamation Approvals • Clean Air/Water Permits • Historical Resource Permits • Road Use Agreements.
	• research requirements for the renewal and/or extension of different permits, licences and agreements	Discuss what happens when particular leases/claims lapse.
	• explain the role of consultation (with other resource users) and public involvement in allocating land and resources for development, and in balancing interests among key stakeholder groups.	Involve students in role-playing activities that include negotiation and debate.

MODULE ENM2020: CONVENTIONAL OIL/GAS 1 (RESOURCE EXPLORATION)

Level: Intermediate

Theme: Technology and Applications

Prerequisite: None

Module Description: Students examine specific exploration techniques and technologies within the context of Alberta's conventional oil and/or gas deposits, and they describe related career opportunities.

Module Parameters: Access to government and industry organizations involved in the exploration of conventional oil and gas deposits (e.g., Alberta Energy and Utilities Board, Petroleum Communication Foundation, local industry).

This module requires off-campus learning experiences and should be combined with relevant work study, work experience and/or modules from the Career Transitions strand; consultation with the work-site supervisor will ensure that relevant safety considerations are addressed.

See the *Off-Campus Education Guide for Administrators, Counsellors and Teachers* (Alberta Education) for further information regarding off-campus learning.

Supporting Modules: ENM1020 Nonrenewable Resources
CTR2210 Workplace Safety (Practices) [Career Transitions Strand]; recommended for off-campus learning

Students must have a general knowledge of potential hazards and accepted safety practices relevant to specific exploration sites prior to engaging in off-campus learning experiences. See Planning for Instruction in Section C for further information regarding student safety.

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Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • **demonstrate knowledge of current and emerging technologies used in the exploration of conventional oil and gas deposits**	*Assessment of student achievement should be based on:* • completing a research project on conventional oil and gas exploration in Alberta. Research to address: – the formation and migration of conventional underground oil and gas deposits – subsurface rock structures capable of trapping oil and gas deposits – techniques used to identify sedimentary basins likely to contain petroleum – techniques used to estimate recoverable oil and gas reserves. *Assessment Tool* *Research Process: Conventional Oil and Gas Exploration, ENM2020–1* *Standard* *Complete all components of research to a standard of 2 on the rating scale* • through field-based investigations, identifying applications of principles of science and technology in seismic and drilling operations. Investigations to address: – use of shot hole rig seismology, vibroseis units and 3D scanning – rotary and top-drive drilling systems. *Assessment Tool* *Observation Checklist for Field-based Investigations, ENMOBS* *Standard* *Complete all sections of the observation checklist for field-based investigations*	60

MODULE ENM2020: CONVENTIONAL OIL/GAS 1 (RESOURCE EXPLORATION) (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
	• a concept test in which the student demonstrates knowledge of: – seismic theory, instruments used in a seismic survey and recent innovations in seismic technology – components of a drilling rig, drilling procedures, logging and testing techniques, and recent innovations in drilling technology. *Assessment Tool* Energy Source/Applications/Alternatives *(Instructor's Manual)* *Standard* *Response indicating 60% mastery*	
	• a summary of environmental assessment and management practices conducted by industry throughout exploration operations. *Assessment Tool* *Presentations/Reports: Intermediate Level, ENMPRE–2* *Standard* *Achieve a minimum rating of 2 on the rating scale for Presentations/Reports*	
• **interpret sample seismic log data and well logs in order to predict the nature and extent of a hydrocarbon deposit**	• through field-based investigations: – identifying applications of principles of science and technology in collecting and evaluating well data – predicting the presence of hydrocarbon-bearing rock structures from sample seismic log data and sample well log data. *Assessment Tool* *Observation Checklist for Field-based Investigations, ENMOBS* An Introduction to the Petroleum Industry, *Chapter 6* *Standard* *Complete all sections of the observation checklist for field-based investigations and answer all questions/exercises on Chapter 6 (pp. 6–14)*	30

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Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• describe career opportunities relevant to the exploration sector of the conventional oil and gas industry	• conducting research on technical, professional and/or labour-based careers in conventional oil and gas exploration. *Assessment Tool* *Career Search: Intermediate Level, ENMCAR–2* *Standard* *Conduct research to a standard of 2 on the rating scale*	10
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Exploration Technology	• explain basic theories and/or principles regarding the formation and migration of conventional underground oil and gas deposits	Describe and illustrate: • theories of origin/ formation • source rock and migration • the difference between porosity and permeability.
	• gather information regarding probable reserves of oil and gas in major sedimentary basin areas of Canada	Contact the Alberta Geological Survey to obtain copies of: • *Atlas of the Western Canadian Sedimentary Basin* • *Edmonton Beneath Our Feet.*
	• illustrate subsurface rock structures capable of trapping oil and gas deposits: – anticlinal trap – fault trap – stratigraphic trap – reef trap	
	• explain applications of aerial surveys and satellite imagery in identifying sedimentary basins likely to contain petroleum	For example: • 3-D scanning • measurement of magnetic fields, gravity and radiation.

MODULE ENM2020: CONVENTIONAL OIL/GAS 1 (RESOURCE EXPLORATION) (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Exploration Technology (continued)	• describe steps taken to gather further information about subsurface rock formations within a basin prior to seismic and/or drilling operations: – first-hand observation of outcrop geology and surface features – review of existing information	For example: • government reports and other published papers (*Geological Survey of Canada*) • previous exploration results from nearby/similar areas.
	• research current and emerging applications of seismic technology in mapping potential oil and gas-bearing formations: – seismic theory – data collection and processing	Research applications of computer-assisted processing in providing 2-D and 3-D analyses of sedimentary structures.
	• research current and emerging applications of drilling technology in determining the composition of subsurface rock and the presence of oil and gas deposits: – drill rig components – drilling techniques – logging and testing procedures	Identify general parts of a drilling rig and accompanying equipment. Explain the process of "making hole." Discuss the use of cuttings and cores in determining the properties of subsurface rock structures. Research directional, horizontal and under-balanced drilling techniques. Research environmental standards and the enforcement of safe operating procedures for seismic and drilling rigs.
	• explain environmental assessment and management practices conducted by industry throughout exploration operations • describe technological advances used to address environmental concerns throughout the exploration process.	Gather information about exploration techniques adopted to maintain environmental standards; e.g.: • seismic technology • horizontal drilling • use of helicopters/ packhorses • disposal of drilling fluids.

MODULE ENM2020: CONVENTIONAL OIL/GAS 1 (RESOURCE EXPLORATION) (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Data Interpretation	• explain basic terminology and methodology used in seismic line analysis • given sample seismic line data, make predictions regarding the presence of hydrocarbon-bearing rock structures • explain basic terminology and methodology used in geological log analysis • given sample well log data, make predictions regarding the presence of a hydrocarbon deposit • estimate the potential volume of a hydrocarbon deposit using sample seismic line and well log data.	Establish links with local industry for first-hand observation of technologies/techniques used in data interpretation. Only a **RUDIMENTARY UNDERSTANDING** of terminology and methodology need to be developed at this time. Identify types of information recorded in well log records; e.g.: • type and thickness of rock layers • speed of penetration. Research the use of wireline logging tools in transmitting data about: • thickness, porosity and permeability • fluid composition of rock formations.
Career Opportunities	• research careers and the range of occupational opportunities related to the exploration of conventional oil and gas deposits; e.g.: – earth science – land survey and access – seismic and drilling service – environmental management • evaluate current employment opportunities based on employment statistics • research trends in the oil and gas exploration industry, and future career opportunities.	Plan for individual/group research and presentations that address: • job description • employment market • education/training • wage expectations. Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development). See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions. Arrange/facilitate: • information interviews • work study/experience • job shadowing.

MODULE ENM2030: OIL SANDS/HEAVY OIL/COAL 1 (RESOURCE EXPLORATION)

Level: Intermediate

Theme: Technology and Applications

Prerequisite: None

Module Description: **Students examine specific exploration techniques and technologies within the context of Alberta's oil sands, heavy oil or coal deposits, and they describe related career opportunities.**

Module Parameters: Access to government and industry organizations involved in the exploration of nonconventional hydrocarbon resources (e.g., Fort McMurray Oil Sands Interpretive Centre, Western Research Centre).

This module requires off-campus learning experiences and should be combined with relevant work study, work experience and/or modules from the Career Transitions strand; consultation with the work-site supervisor will ensure that relevant safety considerations are addressed.

See the *Off-Campus Education Guide for Administrators, Counsellors and Teachers* (Alberta Education) for further information regarding off-campus learning.

Supporting Modules: ENM1020 Nonrenewable Resources
CTR2210 Workplace Safety (Practices) [Career Transitions Strand]; recommended for off-campus learning

Students must have a general knowledge of potential hazards and accepted safety practices relevant to specific exploration sites prior to engaging in off-campus learning experiences. See Planning for Instruction in Section C of this Guide for further information regarding student safety.

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Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • **demonstrate knowledge of current and emerging technologies used in the exploration of oil sands, heavy oil or coal deposits**	*Assessment of student achievement should be based on:* • completing a research project on nonconventional hydrocarbon exploration. Research to address: – the origin and formation of oil sands, heavy oil or coal deposits – surface and subsurface rock structures capable of containing oil sands, heavy oil or coal deposits – steps taken in locating potential oil- or coal-bearing formations prior to seismic and/or drilling operations – techniques used to estimate recoverable deposits of bitumen, heavy oil or coal. *Assessment Tool* *Research Process: Exploration of Nonconventional Hydrocarbon Deposits, ENM2030–1* *Standard* *Complete all components of research to a standard of 2 on the rating scale* • through field-based investigations: – identifying applications of principles of science and technology in one or more areas of resource exploration (e.g., seismology, drilling) – examining the effect of overburden, oil density and viscosity, and/or rock porosity and permeability on recovery potential for an oil sand, heavy oil or coal deposit. *Assessment Tool* *Observation Checklist for Field-based Investigations, ENMOBS* *Standard* *Complete all sections of the observation checklist for field-based investigations*	60

MODULE ENM2030: OIL SANDS/HEAVY OIL/COAL 1 (RESOURCE EXPLORATION)
(continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
	• a concept test in which the student demonstrates knowledge of: – the characteristics and distinguishing features of three or more different oil- or coal-bearing formations – seismic, drilling and/or other technology used in establishing the presence of nonconventional hydrocarbon deposits. *Assessment Tool* Energy Sources/Applications/Alternatives *(Instructor's Manual)* *Standard* *Response indicating 60% mastery*	
	• a summary of environmental assessment and management practices conducted by industry throughout exploration operations. *Assessment Tool* *Presentations/Reports: Intermediate Level, ENMPRE–2* *Standard* *Achieve a minimum rating of 2 on the rating scale for Presentations/Reports*	
• **explain applications of low-depth drilling and log analysis in predicting the nature and extent of an oil sands, heavy oil or coal deposit**	• through field-based investigations, analyzing assays/core samples and sample log data to predict the nature and extent of an oil sands, heavy oil or coal deposit. *Assessment Tool* *Observation Checklist for Field-based Investigations, ENMOBS* *Standard* *Complete all sections of the observation checklist for field-based investigations*	20

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Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **describe career opportunities relevant to the exploration sector of the oil sands, heavy oil or coal industry**	• conducting research on technical, professional and/or labour-based careers within the exploration sector of an oil sands or coal industry. *Assessment Tool* *Career Search: Intermediate Level, ENMCAR–2* *Standard* *Conduct research to a standard of 2 on the rating scale*	20
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Exploration Technology	• explain basic theories and/or principles regarding the origin and formation of oil sands, heavy oil or coal deposits in Alberta; e.g.: – theories of origin/formation – surface and subsurface geology	Describe and illustrate: • theories of origin/ formation • source rock and migration • the difference between porosity and permeability.
	• identify major geographical areas of Alberta in which oil sands, heavy oil or coal deposits are located, and relate geographic patterns to theories of origin	For example: • Why are oil sands and heavy oils in arc-like distribution patterns? • Does this help to include/exclude areas for exploration?
	• compare and contrast physical and chemical characteristics of oil sands, heavy oil, conventional oil and coal	
	• compare known reserves of energy stored in oil sands and coal to known reserves of energy available through other fossil fuels; e.g.: – in Alberta – in Canada – in the world	Identify major oil sands deposits in Alberta: • Athabasca • Cold Lake • Peace River • Wabasca.

MODULE ENM2030: OIL SANDS/HEAVY OIL/COAL 1 (RESOURCE EXPLORATION) (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Exploration Technology (continued)	• describe techniques used to estimate Alberta's recoverable heavy oil, bitumen and coal	Compare the concepts of "proved reserve," "probable reserve" and "established reserve."
	• illustrate surface and subsurface rock structures capable of containing oil sands, heavy oil or coal deposits	Compare coals from different regions of Alberta; e.g.: • mountain coals • foothills coals • plains coals.
	• explain applications of aerial surveys and satellite imagery in locating nonconventional hydrocarbon deposits	For example: • 3-D scanning • measurement of magnetic fields, gravity and radiation.
	• describe steps taken to gather further information about potential oil- or coal-bearing formations prior to seismic and drilling operations; e.g.: – first-hand observation of outcrop geology and surface features – review of geological reports and other published papers	Discuss information included in geological reports available from: • Alberta Geological Survey • Alberta Oil Sands Technology and Research Authority.
	• research current and emerging applications of seismic technology in the mapping and analysis of potential oil- or coal-bearing formations; e.g.: – seismic theory – data collection and processing	Research applications of computer-assisted processing in providing 2-D and 3-D analyses of subsurface rock structures.
	• research current and emerging applications of drilling or other exploration technology in determining the composition of subsurface rock and establishing the presence of nonconventional hydrocarbon deposits	Identify the general parts of a drilling rig and accompanying equipment. Explain the process of "making hole." Discuss the use of cuttings and cores in determining the properties of subsurface rock structures. Research directional drilling.

Concept	Specific Learner Expectations	Notes
Exploration Technology (continued)	*The student should:* • explain environmental assessment and management practices conducted by industry throughout exploration operations; e.g.: – AEUB policies and guidelines – water, soil and wildlife impact studies – management plans – reclamation techniques • describe technological advances used to address environmental concerns throughout the exploration process.	Research environmental standards and the enforcement of safe operating procedures throughout exploration activities. Gather information regarding exploration procedures followed to maintain environmental standards; e.g.: • horizontal drilling • disposal of drilling fluids • land surface restoration.
Data Interpretation	• explain basic terminology and methodology used in low-depth drilling and core analysis • given assays or samples, make predictions regarding the extent and grade of an oil sands, heavy oil or coal deposit • explain basic terminology and methodology used in geological log analysis; e.g.: – electric logs – sonic logs • given sample log data from a bore hole, make predictions regarding the extent and grade of an oil sands, heavy oil or coal deposit • describe hydrocarbon content necessary to make a nonconventional hydrocarbon deposit economically viable; e.g.: – percentage of bitumen – rank of coal.	Establish links with local industry for first-hand observation of technologies/techniques used in data interpretation. Only a **RUDIMENTARY UNDERSTANDING** of terminology and methodology needs to be developed at this time. Discuss types of information recorded in well log records.

MODULE ENM2030: OIL SANDS/HEAVY OIL/COAL 1 (RESOURCE EXPLORATION) (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Career Opportunities	• research careers and the range of occupational opportunities related to the exploration of nonconventional hydrocarbon deposits; e.g.: – earth science: • geologist • geophysicist • geochemist • paleontologist – survey and land access: • surveyor • land agent – seismic and drilling service: • contractor • mechanic • rig worker – engineering: • reservoir • mining – environmental management: • environmental auditor • environmental engineer	Plan for individual/group research and presentations that address: • job description • employment market • education/training • wage expectations. Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development).
	• evaluate current employment opportunities in exploration based on employment statistics • research recent changes in prospecting and exploration technology, and resulting career opportunities and trends.	See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions. Arrange/facilitate: • information interviews • work study/experience • job shadowing.

MODULE ENM2040: METALS/NONMETALS 1 (RESOURCE EXPLORATION)

Level: Intermediate

Theme: Technology and Applications

Prerequisite: None

Module Description: Students examine specific exploration techniques and technologies within the context of a metallic and/or nonmetallic mineral deposit, and they describe related career opportunities.

Note: Industry often refers to a third category of minerals called "structural materials"; i.e., minerals used primarily in construction, including sand and gravel, decorative and building stone, cement, clay and limestone. Modules ENM2040 and ENM3040 include structural materials within the broader category of nonmetallic minerals.

Module Parameters: Access to government and industry organizations involved in the exploration of metallic and/or non-metallic minerals.

This module requires off-campus learning experiences and should be combined with relevant work study, work experience and/or modules from the Career Transitions strand; consultation with the work-site supervisor will ensure that relevant safety considerations are addressed.

See the *Off-Campus Education Guide for Administrators, Counsellors and Teachers* (Alberta Education) for further information regarding off-campus learning.

Supporting Modules: ENM1020 Nonrenewable Resources
CTR2210 Workplace Safety (Practices) [Career Transitions Strand]; recommended for off-campus learning

Students must have a general knowledge of potential hazards and accepted safety practices relevant to specific exploration sites prior to engaging in off-campus learning experiences. See Planning for Instruction in Section C for further information regarding student safety.

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MODULE ENM2040: METALS/NONMETALS 1 (RESOURCE EXPLORATION) (continued)

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • **demonstrate knowledge of current and emerging technologies used in the exploration of economic mineral deposits**	*Assessment of student achievement should be based on:* • completing a research project on the exploration of economic mineral deposits. Research to address: – the origin and formation of metallic and nonmetallic minerals – surface and subsurface rock structures capable of containing metallic and nonmetallic minerals and structural materials – steps taken in locating potential mineral-bearing formations prior to seismic mapping and/or drilling operations – techniques used to estimate recoverable mineral deposits. *Assessment Tool* *Research Process: Exploration of Mineral Deposits, ENM2040–1* *Standard* *Complete all components of research to a standard of 2 on the rating scale* • through field-based investigations: – identifying applications of principles of science and technology in one or more areas of resource exploration (e.g., seismology, drilling) – examining factors that affect the recovery potential for a mineral deposit (e.g., depth of overburden, size/nature of deposit). *Assessment Tool* *Observation Checklist for Field-based Investigations, ENMOBS* *Standard* *Complete all sections of the observation checklist for field-based investigations*	60

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:* • a concept test in which the student demonstrates knowledge of: – the characteristics and distinguishing features of six or more different metallic or nonmetallic minerals found in Alberta – seismic, drilling and/or other technology used in establishing the presence of economic mineral deposits. *Assessment Tool* Exploring Manufacturing *(Instructor's Manual)* *Standard* *Response indicating 60% mastery* • a summary of environmental assessment and management practices conducted by industry throughout exploration operations. *Assessment Tool* *Presentations/Reports: Intermediate Level, ENMPRE–2* *Standard* *Achieve a minimum rating of 2 on the rating scale for Presentations/Reports*	
• **interpret geological logs in order to predict the nature and extent of a metallic or nonmetallic mineral deposit**	• through field-based investigations, analyzing assays/core samples and sample log data to predict the nature and extent of a metallic and/or nonmetallic mineral deposit. *Assessment Tool* *Observation Checklist for Field-based Investigations, ENMOBS* *Standard* *Complete all sections of the observation checklist for field-based investigations*	20

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MODULE ENM2040: METALS/NONMETALS 1 (RESOURCE EXPLORATION) (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• describe career opportunities relevant to the exploration sector of the mineral industry	• conducting research on technical, professional and/or labour-based careers within the exploration sector of a mineral industry. *Assessment Tool* *Career Search: Intermediate Level, ENMCAR–2* *Standard* *Conduct research to a standard of 2 on the rating scale*	20
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Exploration Technology	• explain basic theories and/or principles regarding the origin and formation of metallic and nonmetallic minerals and structural materials in Alberta • illustrate surface and subsurface rock structures in which metallic and industrial minerals are commonly found • describe the mineral potential of major geological areas of Alberta; e.g.: – Precambrian Shield – Interior Plains – Foothills – Rocky Mountains • identify geographical areas of Alberta in which occurrences of specific minerals are known to exist, and relate geographic patterns to theories of origin	Describe and illustrate: • theories of origin/ formation • surface and subsurface geology. Contact the Alberta Geological Survey to obtain *Edmonton Beneath Our Feet.* Request the current *Mineral Deposits and Occurrences in Alberta* map and data base from the Alberta Geological Survey. For example: • Why is a mineral found in a particular distribution pattern? • Does this help to include/exclude areas for exploration?

MODULE ENM2040: METALS/NONMETALS 1 (RESOURCE EXPLORATION) (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Exploration Technology (continued)	• explain possible reasons why the potential of the minerals industry in Alberta has not been fully established, nor have known deposits of industrial and metallic minerals been fully developed	Contact Natural Resources Canada for its map (produced annually) of energy and mineral developments in Canada.
	• explain applications of aerial surveys and satellite imagery in prospecting for metallic and nonmetallic minerals	Discuss information included in geological reports available from: • Alberta Geological Survey (industrial and structural materials, metals) • Geological Survey of Canada (metals).
	• describe steps taken to gather further information about potential mineral-bearing formations prior to seismic mapping and/or drilling operations; e.g.: – first-hand observation of outcrop geology and surface features – review of geological reports and other published papers	
	• research current and emerging applications of technology in the mapping and analysis of potential mineral-bearing formations	For example: • air and ground magnetics • electromagnetics • gravity • radioactivity • geochemistry of soils and other overburden.
	• research current and emerging applications of drilling technology in determining the composition of subsurface rock and establishing the presence of mineral deposits	Gather information on rig components, drilling techniques and logging/testing procedures.
	• summarize recent developments in Alberta regarding gold, diamonds and base-metals	Research environmental standards and the enforcement of safe operating procedures throughout exploration activities.
	• explain environmental assessment and management practices conducted by industry throughout exploration operations	
	• describe technological advances used to address environmental concerns throughout the exploration process	Gather information regarding exploration procedures followed to maintain environmental standards; e.g.: • horizontal drilling • disposal of drilling fluids • land surface restoration.

Concept	Specific Learner Expectations	Notes
	The student should:	
Data Interpretation	• explain basic terminology and methodology used in core analysis • given assays or samples, make predictions regarding the extent and grade of a mineral deposit • explain basic terminology and methodology used in geological log interpretation; e.g.: – electric logs – sonic logs • given sample log data from a bore hole, make predictions regarding the extent and grade of a mineral deposit.	Establish links with local industry for first-hand observation of technologies/ techniques used in data interpretation. Only a **RUDIMENTARY UNDERSTANDING** of terminology and methodology needs to be developed at this time. Discuss types of information recorded in log data from bore holes.
Career Opportunities	• research careers and the range of occupational opportunities related to the exploration of metallic and nonmetallic mineral deposits; e.g.: – earth science: • geologist • geophysicist • geochemist – technologists and technicians: • field • laboratory – computer analysis: • data base • data entry • Geographic Information Systems – survey and land access: • surveyor • land agent – seismic and drilling service: • contractor • mechanic • rig worker – environmental management: • environmental auditor • environmental engineer • evaluate current employment opportunities in mineral exploration based on employment statistics	Plan for individual/group research and presentations that address: • job description • employment market • education/training • wage expectations. Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development). See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.

MODULE ENM2040: METALS/NONMETALS 1 (RESOURCE EXPLORATION) (continued)

Concept	Specific Learner Expectations	Notes
Career Opportunities (continued)	*The student should:* • research recent changes in prospecting and exploration technology, and resulting career opportunities and trends.	Arrange/facilitate: • information interviews • work study/experience • job shadowing.

MODULE ENM2050: RENEWABLE ENERGY TECHNOLOGY

Level: Intermediate

Theme: Technology and Applications

Prerequisite: ENM1050 Renewable Resources

Module Description: Students define and explain the need for sustainable energy development, research one or more renewable energy technologies; e.g., hydro, wind, solar, tidal, biomass, geothermal, nuclear, hydrogen, ethanol, blended fuel, fuel cell, and construct a model of a renewable energy system.

Module Parameters: Access to a construction, fabrication, mechanics and/or science laboratory.

Access to relevant government, industry and community resources (e.g., Alberta Energy, Alberta Environmental Protection, Energy Efficiency Association of Alberta, Pincher Creek Development and Information Centre, Biomass Energy Institute, Canadian Wind Energy Association, Solar Energy Society of Canada, Small Power Producers Association of Alberta).

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • explain the role of renewable energy sources in sustainable energy development	*Assessment of student achievement should be based on:* • a presentation or report on the role of alternative sources of energy in sustainable energy development. Report to provide: – a definition of sustainable energy development based on social, economic and environmental perspectives – a comparison of nonrenewable and renewable energy resources with respect to technological/ geological requirements, cost, environmental impact and sustainability – a survey of alternative sources of energy available in Alberta and Canada – forecasts regarding future energy supply and demand, and options for sustainability in the energy sector. *Assessment Tool* *Presentations/Reports: Intermediate Level, ENMPRE–2* *Standard* *Achieve a minimum rating of 2 on the rating scale for Presentations/Reports*	25

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate applications of one or more renewable energy technologies	• given a specific energy need: – designing and constructing a model of an alternative energy system to meet that need. Design and model to address: • component parts and principles of operation • efficient use of resources • energy conversion and feedback systems • human and environmental safety – analyzing the energy system with respect to: • advantages/disadvantages and ability to meet identified needs • potential for current and future use in Alberta. *Assessment Tool* *Project Assessment: Technology Design, ENMTEC* *Assessment Criteria: Diagrams and Technical Drawings, ENMDRA* *Standard* *Complete the design and construct the model to a standard of 2 on the rating scale*	65
• describe career opportunities relevant to renewable energy development	• completing a research project on one or more career clusters in alternative energy development. *Assessment Tool* *Career Search: Intermediate Level, ENMCAR–2* *Standard* *Conduct research to a standard of 2 on the rating scale*	10
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

MODULE ENM2050: RENEWABLE ENERGY TECHNOLOGY (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Sustainable Development	• compare and contrast nonrenewable and renewable sources of energy	Research/debate the statement – "there is no such thing as renewable energy."
	• identify environmental issues resulting from the use of nonrenewable energy	For example: • greenhouse gases • acid deposition • resource depletion.
	• define and explain the need for sustainable energy development	Discuss the meaning of the phrase "soft energy path"; e.g.: • least-cost energy strategy • efficient energy use • sustainable energy path.
	• research forecasts regarding future energy supply and demand, and options for ensuring a sustainable future	Consider options such as: • using less • finding alternative sources.
	• identify and describe renewable sources of energy supply; e.g.: – hydro production – wind and solar – biomass – geothermal – nuclear – hydrogen fuel	Which alternative energy sources have the greatest potential for use in Alberta? Why? Consider impacts of dam construction on: • agriculture • aesthetics • wildlife.
	• identify social, economic and environmental issues resulting from the use of renewable energy.	
Renewable Energy Technology	• research the use of a renewable energy source in Canada and, if possible, use Alberta examples	Investigate and report on: • the technologies used • production methods • efficiency and power coefficient.
	• construct diagrams and models of an energy system that involves use of a renewable energy source	Models/diagrams should clearly illustrate: • component parts • principles of operation • energy conversion • feedback systems.

MODULE ENM2050: RENEWABLE ENERGY TECHNOLOGY (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Renewable Energy Technology (continued)	• describe current and potential applications of renewable energy technology in Alberta and Canada	Research government policies supporting the development of renewable energy technology; e.g.: • Southwest Alberta Renewable Energy Initiative • Alberta Small Power Research and Development Program.
	• compare the renewable energy source/technology with conventional energy sources/technologies.	Consider advantages and disadvantages of the renewable energy technology, and its potential for use.
Career Opportunities	• research careers and the range of occupational opportunities that involve the development of renewable energy; e.g.: – engineering – technical and support services – environmental management	Plan for individual/group research and presentations that address: • job description • employment market • education/training • wage expectations. Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development).
	• evaluate current employment opportunities based on employment statistics	See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.
	• research trends in renewable energy development, and future career opportunities.	Arrange/facilitate: • information interviews • work study/experience • job shadowing.

MODULE ENM2060: REFINING HYDROCARBONS

Level: Intermediate

Theme: Technology and Applications

Prerequisite: None

Module Description: Students examine the principles and technologies involved in processing natural gas, refining crude oil, upgrading heavy oils and bitumen, or processing coal. Students also describe related career opportunities.

Module Parameters: Access to a hydrocarbon refining industry.

Access to a science laboratory.

This module requires off-campus learning experiences and should be combined with relevant work study, work experience and/or modules from the Career Transitions strand; consultation with the work-site supervisor will ensure that relevant safety considerations are addressed.

See the *Off-Campus Education Guide for Administrators, Counsellors and Teachers* (Alberta Education) for further information regarding off-campus learning.

Supporting Modules: ENM1060 Consumer Products & Services
CTR2210 Workplace Safety (Practices) [Career Transitions Strand]; recommended for off-campus learning

Students must have a general knowledge of potential hazards and accepted safety practices relevant to specific processing sites prior to engaging in off-campus learning experiences. See Planning for Instruction in Section C of this Guide for further information regarding student safety.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • describe commodity inputs and consumer products characteristic of the hydrocarbon processing industry	*Assessment of student achievement should be based on:* • identifying and describing the range of products provided as a result of processing natural gas, refining crude oil, upgrading heavy oil/bitumen and processing coal. *Assessment Tool* Our Petroleum Challenge: Into the 21st Century, *Petroleum Communication Foundation* *Standard* *Identify 50 products, their derivatives, and general application/use*	20

MODULE ENM2060: REFINING HYDROCARBONS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
	• given a specific hydrocarbon processing industry, identifying: – inputs to processing, refining or upgrading within the industry – economic, environmental, safety and other factors that influence industry practices. *Assessment Tool* *Research Process: Hydrocarbon Processing, ENM2060–1* *Standard* *Complete all components of research to a standard of 2 on the rating scale*	
• explain techniques used to process natural gas, refine crude oil, upgrade heavy oils and bitumen, or process coal	• through laboratory and/or field-based investigations: – identifying the physical and chemical properties of a hydrocarbon – relating properties of a hydrocarbon to techniques used for processing, refining or upgrading. *Assessment Tool* *Lab Investigations: Intermediate Level, ENMLAB–2* *Observation Checklist for Field-based Investigations, ENMOBS* *Standard* *Conduct lab investigations to a standard of 2 on the rating scale and/or complete all sections of the observation checklist for field investigations*	60
	• a flow chart that outlines major steps and processes used by the upstream sector to process natural gas, refine crude oil, upgrade heavy oil/bitumen or process coal. *Assessment Tool* *Assessment Criteria: Flow Charts, ENMFLO* *Standard* *Complete the flow chart to a standard of 2 on the rating scale*	

MODULE ENM2060: REFINING HYDROCARBONS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
	• a summary of environmental assessment and management practices conducted by industry throughout processing, refining or upgrading operations. *Assessment Tool* *Presentations/Reports: Intermediate Level, ENMPRE–2* *Standard* *Achieve a minimum rating of 2 on the rating scale for Presentations/Reports*	
• describe career opportunities relevant to the processing or refining sector of a hydrocarbon industry	• conducting research on technical, professional and/or labour-based careers that involve processing natural gas, refining crude oil, upgrading heavy oils and bitumen, or processing coal. *Assessment Tool* *Career Search: Intermediate Level, ENMCAR–2* *Standard* *Conduct research to a standard of 2 on the rating scale*	20
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
The Processing Industry	• describe the range of products and/or services provided as a result of: – processing natural gas – refining crude oil – upgrading heavy oils and bitumen – processing coal	Prepare posters and displays of products and services derived from different types of hydrocarbons (e.g., natural gas, crude oil, heavy oil/bitumen, coal).

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Concept	Specific Learner Expectations	Notes
	The student should:	
The Processing Industry (continued)	• describe inputs to processing within an oil, gas, oil sands or coal industry: – raw materials/feedstocks – financial, human and natural resources – technology requirements	Consider the sour gas industry and production of elemental sulphur used in the manufacture of fertilizers, paper, pharmaceuticals, etc.
	• identify factors that influence the nature of a processing or refining industry	Given a specific industry, research the influence of factors such as: • supply of feedstocks and/or other materials • allowable production volumes • access to markets.
	• explain how the mix of products produced may vary according to market demand	For example: • asphalt for road paving in summer • home heating fuels in winter.
	• identify environmental and safety concerns that influence practices within a processing or refining industry.	Discuss industry impact on: • workers and nearby residents • crops, forests, livestock and wildlife • air, soil and water quality.
Processing/Refining Techniques	• describe relatively simple field facilities used to prepare a raw hydrocarbon for further processing and/or refining in the upstream sector	Consider recovery-site or satellite facilities used for: • cleaning • separating • upgrading.
	• research more sophisticated techniques and technologies used in the upstream sector to process natural gas, refine crude oil, upgrade heavy oil and bitumen, or process coal; e.g.: – removal of contaminants/impurities – conversion into saleable products	Consider both sweet and sour facilities in the upstream sector. If studying crude oil, distinguish between the refining of crude oil (ENM2060) and the manufacture of petrochemicals (ENM3060).

MODULE ENM2060: REFINING HYDROCARBONS (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Processing/Refining Techniques (continued)	• explain reasons for sulphur recovery throughout processing, refining and/or upgrading processes • create a simplified model of a processing, refining or upgrading facility	For example, • to sweeten product for industrial/residential use • to produce elemental sulphur • to maintain environmental standards.
	• research the physical and/or chemical properties of a hydrocarbon, and relate these to technologies used for processing, refining or upgrading	Give examples of hydrocarbons that exist in their natural state as solids, liquids and gases. For a given hydrocarbon, conduct laboratory investigations of: • molecular structure • heat content • temperature/pressure/ volume relationships • catalytic reaction.
	• research basic fractionating, cracking and/or reforming processes used within the industry	Assemble and use a simple fractionating column to separate two or more liquids through the process of fractional distillation.
	• explain industry use of electronic equipment and computer technology in monitoring processing, refining or upgrading operations	Research sulphur-recovery technology. Discuss Canada as a world leader in developing technologies for recovering and safely handling sulphur.
	• describe storage facilities and distribution systems within the industry, and their impact on industry location and product costs	Construct flow charts that illustrate storage and distribution systems.
	• explain environmental assessment and management practices conducted by industry throughout processing, refining or upgrading operations	Research environmental standards and the enforcement of safe operating procedures throughout processing, refining or upgrading operations.

MODULE ENM2060: REFINING HYDROCARBONS (continued)

Concept	Specific Learner Expectations	Notes
Processing/Refining Techniques (continued)	*The student should:* • describe industry initiatives that respond to environmental concerns	For example: • advances in sulphur-recovery technology • development of clean-coal technology • waste treatment/ emission control.
	• describe industry initiatives that address occupational health and safety requirements.	For example, • odour scrubbers • noise suppressants • water purification • personal protective equipment • emergency response strategies.
Career Opportunities	• research careers and the range of occupational opportunities within the processing and refining sector of a hydrocarbon industry; e.g.: – engineering – technical and support services – apprenticeship trades – environmental management • explain the personnel structure within the refining department of a hydrocarbon industry • evaluate current employment opportunities based on employment statistics • research trends in hydrocarbon processing and refining, and future career opportunities; e.g.: – upgrading heavy oil and bitumen – increased use of low ranked coals.	Plan for individual/group research and presentations that address: • job description • employment market • education/training • wage expectations. Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development). See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions. Arrange/facilitate: • information interviews • work study/experience • job shadowing.

MODULE ENM2070: REFINING ROCKS & MINERALS

Level: Intermediate

Theme: Technology and Applications

Prerequisite: None

Module Description: Students examine the principles and processes involved in refining an industrial (nonmetallic) mineral or a metallic mineral, and they describe related career opportunities.

Module Parameters: Access to a rock/mineral processing industry.

Access to a science laboratory.

This module requires off-campus learning experiences and should be combined with relevant work study, work experience and/or modules from the Career Transitions strand; consultation with the work-site supervisor will ensure that relevant safety considerations are addressed.

See the *Off-Campus Education Guide for Administrators, Counsellors and Teachers* (Alberta Education) for further information regarding off-campus learning.

Supporting Modules: ENM1060 Consumer Products & Services
CTR2210 Workplace Safety (Practices) [Career Transitions Strand]; recommended for off-campus learning

Students must have a general knowledge of potential hazards and accepted safety practices relevant to specific processing sites prior to engaging in off-campus learning experiences. See Planning for Instruction in Section C for further information regarding student safety.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • describe commodity inputs and consumer products characteristic of the mineral processing industry	*Assessment of student achievement should be based on:* • identifying and describing the range of products provided as a result of processing and/or refining Alberta's industrial (nonmetallic) and/or metallic minerals. *Assessment Tool* Exploring Manufacturing *Standard* *Identify 50 products, their derivatives and general application/use*	20

MODULE ENM2070: REFINING ROCKS & MINERALS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:* • given a specific mineral processing industry, identifying: – inputs to processing and/or refining within the industry – economic, environmental, safety and other factors that influence industry practices. *Assessment Tool* *Research Process: Mineral Processing, ENM2070–1* *Standard* *Complete all components of research to a standard of 2 on the rating scale*	
• **explain techniques used to refine an industrial (nonmetallic) mineral or a metallic mineral**	• through laboratory and/or field-based investigations: – identifying the physical and chemical properties of a mineral substance – relating properties of a mineral substance to techniques used for processing and/or refining. *Assessment Tool* *Lab Investigations: Intermediate Level, ENMLAB–2* *Observation Checklist for Field-based Investigations, ENMOBS* *Standard* *Conduct lab investigations to a standard of 2 on the rating scale and/or complete all sections of the observation checklist for field investigations*	60

MODULE ENM2070: REFINING ROCKS & MINERALS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
	• a flow chart that outlines major steps and processes used to refine an industrial (nonmetallic) or metallic mineral. *Assessment Tool* *Assessment Criteria: Flow Charts, ENMFLO* *Standard* *Complete the flow chart to a standard of 2 on the rating scale*	
	• a summary of environmental assessment and management practices conducted by industry throughout processing and refining operations. *Assessment Tool* *Presentations/Reports: Intermediate Level, ENMPRE–2* *Standard* *Achieve a minimum rating of 2 on the rating scale for Presentations/Reports*	
• describe career opportunities relevant to the processing sector of a rock or mineral industry	• conducting research on technical, professional and/or labour-based careers within the processing or refining sector of a rock or mineral industry. *Assessment Tool* *Career Search: Intermediate Level, ENMCAR–2* *Standard* *Conduct research to a standard of 2 on the rating scale*	20
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

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Concept	Specific Learner Expectations	Notes
	The student should:	
The Processing Industry	• explain the social, economic and environmental significance of Alberta's rocks and minerals	Obtain copies of: • *Edmonton Beneath Our Feet* (Alberta Geological Survey) • *Canadian Minerals Yearbook* (Natural Resources Canada) • *Aggregates* (Alberta Sand and Gravel Association).
	• describe applications of Alberta's industrial (nonmetallic) and metallic minerals • describe inputs to processing within a mineral industry: – mineral ores/aggregates – financial, human and natural resources – technology requirements	Prepare posters/displays of products and services derived from Alberta's minerals; e.g.: • sand and gravel • cement and lime • peat moss • building stone • gypsum • clay products • sulphur • salt • gold and copper • iron ore • lead and zinc.
	• identify factors that influence the nature of a mineral processing industry	Given a specific industry, research the influences of factors such as: • supply of raw materials • allowable production volumes • access to markets.
	• identify environmental and safety concerns that influence practices within a mineral processing industry.	Discuss industry impact on: • workers and nearby residents • crops, forests, livestock and wildlife • air, soil and water quality.

MODULE ENM2070: REFINING ROCKS & MINERALS (continued)

Concept	Specific Learner Expectations	Notes
Processing and Refining Techniques	*The student should:*	
	• explain the stages, steps and technologies used in processing an industrial (nonmetallic) or metallic mineral; e.g.: – milling, dressing and cleaning – smelting, refining and upgrading	Contact Natural Resources Canada to obtain posters available on mineral processing and refining.
	• demonstrate basic extractive technologies used in the mineral industry; e.g.: – thermal – mechanical – chemical – electrical	Conduct laboratory investigations that demonstrate: • heat application • grinding/pulverizing • leaching • electrolysis • floatation.
	• create a simplified model of a mineral processing/ refining facility	
	• research the physical and chemical properties of a mineral substance, and relate these to technologies used for processing and refining	For a given mineral substance, conduct laboratory investigations of: • molecular structure • mass and density • magnetic characteristics • elasticity and stress. Encourage students to link experimental outcomes to studies in the core science program.
	• explain industry use of electronic equipment and computer technology in monitoring and controlling refining processes	Research the development of new materials for specific environments and applications.
	• describe storage facilities and distribution systems within the industry, and their impact on industry location and product costs	Construct flow charts that illustrate storage and distribution systems.
	• explain environmental assessment and management practices conducted by industry throughout refining operations	Research environmental standards and the enforcement of safe operating procedures throughout refining operations.

Concept	Specific Learner Expectations	Notes
	The student should:	
Processing and Refining Techniques (continued)	• describe industry initiatives that respond to environmental concerns	For example: • advances in sulphur-recovery technology • management of reactive rock wastes • waste treatment/ emission control.
	• describe industry initiatives that address occupational health and safety requirements	For example: • odour scrubbers • noise suppressants • water purification.
	• describe industry initiatives in reprocessing and recycling mineral products to ensure a life-cycle approach to resource management.	Obtain the brochure entitled *Aggregates and Our Environment* from the Alberta Sand and Gravel Association.
Career Opportunities	• research careers and the range of occupational opportunities within the processing and refining sector of a mineral industry; e.g.: – engineering – technical and support services – apprenticeship trades – environmental management	Plan for individual/group research and presentations that address: • job description • employment market • education/training • wage expectations.
	• explain the personnel structure within a mineral processing industry	Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development).
	• evaluate current employment opportunities based on employment statistics	See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.
	• research trends in mineral processing and refining, and future career opportunities; e.g.: – mineral upgrading – recycling and utilization – waste management.	Arrange/facilitate: • information interviews • work study/experience • job shadowing.

MODULE ENM2080: SUPPLY & DISTRIBUTION

Level: Intermediate

Theme: Technology and Applications

Prerequisite: None

Module Description: Students research marketing and distribution networks within an energy or mineral industry; examine regulatory structures and policies that influence supply of a commodity, product or service; and describe related career opportunities.

Module Parameters: Access to relevant distribution and marketing facilities.

Supporting Module: ENM1060 Consumer Products & Services

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • explain marketing and distribution systems used within an energy or mineral industry	*Assessment of student achievement should be based on:* • a presentation or report that describes the application of general marketing principles within an energy or mineral industry, and factors/variables that influence marketing and distribution systems within the industry. Report to address: – goals of marketing – laws of supply and demand – market competition – barriers/restrictions to free trade – sources of market information – distribution systems. *Assessment Tool* *Presentations/Reports: Intermediate Level, ENMPRE–2* *Standard* *Achieve a minimum rating of 2 on the rating scale for Presentations/Reports* • a flow chart that traces movement of a commodity or product from recovery-site to consumer. Flow chart to illustrate: – recovery and production – processing and refining – product brokering – transport and distribution. *Assessment Tool* *Assessment Criteria: Flow Charts, ENMFLO* *Standard* *Complete the flow chart to a standard of 2 on the rating scale*	50

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MODULE ENM2080: SUPPLY & DISTRIBUTION (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **describe regulatory structures and policies that influence supply of a commodity, product or service**	• a concept test in which the student demonstrates knowledge of regulatory structures and policies that influence supply of a commodity, product or service. Concept test to address: – supply management, and the differences between open and closed marketing systems – the role and impact of existing regulatory systems and policies – specific marketing structures used to exchange the product or provide the service. *Assessment Tool* *Current marketing policy available from provincial/national agencies (e.g., Alberta Petroleum Marketing commission, National Energy Board)* *Standard* *Response indicating 60% mastery*	30
• **describe career opportunities relevant to the marketing and distribution of an energy or mineral resource**	• conducting a research project on technical, professional and/or labour-based careers within the marketing sector of an energy or mineral industry. *Assessment Tool* *Career Search: Intermediate Level, ENMCAR–2* *Standard* *Conduct research to a standard of 2 on the rating scale*	20
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

MODULE ENM2080: SUPPLY & DISTRIBUTION (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Marketing and Distribution Systems	• identify key markets and destinations for an energy or mineral resource	Consider domestic, national and global markets and destinations.
	• explain major functions of marketing within an energy or mineral industry: – market survey and research – product/service planning – advertising and promotion – price determination – sales	Explore potential links with the Management and Marketing strand.
	• identify basic stages through which a product moves en route to market: – recovery and production – processing and refining – product brokering – transport	Draw posters/flow charts that depict the sequence of events from recovery-site to consumer.
	• explain the laws of supply and demand, and factors that cause changes in supply and demand for a commodity, product or service	Discuss factors that may influence supply and demand; e.g.: • trade regulations • economic conditions • environmental concerns • consumer trends • new technology.
	• identify basic price determinants for a commodity, product or service: – product characteristics – balance between supply and demand – inflation and dollar value – storage/distribution costs	Use weekly marketing reports to develop a graph of price trends. Identify factors causing changes in commodity pricing.
	• research one or more distribution networks used to move a commodity or product to market; e.g.: – pipeline systems – tankers and barges – rail and trucking systems	Prepare flow charts/ diagrams. Explain the effect of transportation factors on: • product price • market extent.
	• explain the function of intermediate stops in moving a commodity or product to market	For example: • terminals • bulk stations.

Concept	Specific Learner Expectations	Notes
Marketing and Distribution Systems (continued)	*The student should:* • identify safety and environmental standards and emergency response plans relevant to transporting an energy or mineral product.	Note links with ENM2100 (Environmental Safety).
Regulatory Structures and Policies	• explain the concept of supply management, and differences between nonregulated (open) and regulated (closed) market systems	Identify industry examples of open and closed market systems.
	• explain the role and impact of regulatory systems and strategies used in marketing a commodity, product or service	For example: • marketing boards • cooperatives • quota systems • monopolies.
	• describe marketing structures used to facilitate commodity exchange and establish benchmark prices	Cite local examples.
	• evaluate the impact of government policies and legislation on marketing activities within an energy or mineral industry	Consider the influences of: • provincial/national/ international trade agreements • deregulation and free trade • transportation policies • safety/environmental standards.
	• describe the mandates of provincial, national and foreign agencies in regulating exchange of a commodity, product or service	For example: • Alberta Petroleum Marketing Commission • National Energy Board • California Gas Transmission Commission.
	• identify and evaluate viable alternatives for marketing within an energy or mineral industry.	Consider opportunities/ obstacles related to: • direct producer marketing • open markets • marketing boards • cooperatives.

MODULE ENM2080: SUPPLY & DISTRIBUTION (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Career Opportunities	• research careers and the range of occupational opportunities related to marketing an energy or mineral resource; e.g.: – market survey – advertising and sales – transportation and distribution – product development – apprenticeship trades – support services • legal • consulting • environmental • engineering	Plan for individual/group research and presentations that address: • job description • employment market • education/training • wage expectations. Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development).
	• identify career opportunities and trends based on employment statistics	See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.
	• research trends in the marketing sector of an energy or mineral industry, and resulting career opportunities.	Arrange/facilitate: • information interviews • work study/experience • job shadowing.

MODULE ENM2090: ENERGY DESIGNS/SYSTEMS 1 (BASIC PRINCIPLES)

Level: Intermediate

Theme: Management and Conservation

Prerequisite: None

Module Description: Students investigate the basic principles of energy conservation and efficiency and relate them to energy designs and systems used in the residential, commercial or transportation sector.

Module Parameters: Access to a construction, fabrication, mechanics or science laboratory.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • **explain basic principles of energy conservation and efficiency**	*Assessment of student achievement should be based on:* • through laboratory investigations, identifying practical applications of: – laws of energy conservation – basic principles of energy efficiency. *Assessment Tool* *Lab Investigations: Intermediate Level, ENMLAB–2* *Standard* *Conduct lab investigations to a standard of 2 on the rating scale* • a concept test in which the student demonstrates knowledge of energy forms, energy conversion, energy conservation and energy efficiency. *Assessment Tool* Transportation, Energy and Power Technology *Standard* *Response indicating 60% mastery*	50

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MODULE ENM2090: ENERGY DESIGNS/SYSTEMS 1 (BASIC PRINCIPLES) (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **demonstrate applications of energy technology in the residential, commercial or transportation sector**	• given a specific residential/commercial structure or transportation system, preparing: – a flow chart and/or diagram that traces energy flow and conversion throughout the structure or system – a model of the structure or system incorporating design elements that address energy conservation and efficiency – a comparison of energy input and energy output for one or more individual components with the structure or system. *Assessment Tool* *Assessment Criteria: Flow Charts, ENMFLO* *Assessment Criteria: Diagrams and Technical Drawings, ENMDRA* *Project Assessment: Technology Design, ENMTEC* *Standard* *Complete the flow chart/diagram, model and comparison to a standard of 2 on the rating scale*	40
• **describe career opportunities relevant to low energy design and technology**	• completing a research project on one or more career opportunities in low energy design and technology. *Assessment Tool* *Career Search: Intermediate Level, ENMCAR–2* *Standard* *Conduct research to a standard of 2 on the rating scale*	10
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

MODULE ENM2090: ENERGY DESIGNS/SYSTEMS 1 (BASIC PRINCIPLES) (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Energy Conservation and Efficiency	• provide a rationale for energy conservation and efficiency based on economic and environmental factors	Research/discuss the statement – "Our society wastes approximately 50% of all its available energy."
	• identify basic forms of energy and describe applications of each: – radiant – chemical – thermal – mechanical – electrical – nuclear	Explain how the sun is the original source of all energy. Trace various forms of energy back to the sun. Distinguish between: • energy and power • kinetic and potential energy.
	• cite examples of energy technology used to convert one form of energy into another useful form	For example: • turbines • generators • motors • electric bulbs.
	• explain applications of the laws of energy conservation: – *First Law of Thermodynamics*	"Energy cannot be created or destroyed. The total energy in any system is considered to be constant."
	– *Second Law of Thermodynamics*	"A natural process always takes place in such a direction as to cause an increase in the randomness (entropy) of the universe."
	• define energy efficiency and explain its application in determining how well a technology converts energy from one form to another.	Distinguish between the efficiency of component parts and that of a total energy system.
Applications of Technology	• identify energy sources for an existing residential/ commercial structure or transportation system	Prepare flow charts that illustrate energy sources, energy conversion and energy transfer throughout a structure or system.

MODULE ENM2090: ENERGY DESIGNS/SYSTEMS 1 (BASIC PRINCIPLES) (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Applications of Technology (continued)	• explain functions of technology in converting energy into useful forms within the structure or system	Prepare diagrams of energy technologies that illustrate component parts and principles of operation.
	• illustrate, by example, applications of energy conservation and efficiency evident in structure or system design	Consider: • mechanical efficiency • volumetric efficiency • thermal efficiency.
	• explain design principles incorporated to transfer energy throughout the structure or system	Design principles and applications will vary according to the structure or system investigated.
	• research methods used to measure energy within the structure or system	For structures investigate: • British thermal unit and calorie • joules, kilojoules and gigajoules. For transportation devices investigate: • horsepower • torque.
	• perform simple calculations and compare energy input/output for components within a structure or system	For example: • windows • lighting • wall structure • insulation.
	• evaluate energy use within the structure or system based on: – total system efficiency – cost of operation – environmental and social effect.	Consider land use, atmospheric emissions, health, convenience, aesthetics.
Career Opportunities	• research careers and the range of occupational opportunities in low energy design and technology; e.g.: – engineering – technical and support services – environmental management	Plan for individual/group research and presentations that address: • job description • employment market • education/training • wage expectations. Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development)

MODULE ENM2090: ENERGY DESIGNS/SYSTEMS 1 (BASIC PRINCIPLES) (continued)

Concept	Specific Learner Expectations	Notes
Career Opportunities (continued)	*The student should:* • identify career opportunities and trends based on employment statistics • research trends in low energy designs and systems, and resulting career opportunities.	See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions. Arrange/facilitate: • information interviews • work study/experience • job shadowing.

MODULE ENM2100: ENVIRONMENTAL SAFETY

Level:	Intermediate
Theme:	Management and Conservation
Prerequisite:	None
Module Description:	Students identify environmental hazards that result from activities within an energy or mineral industry, and describe specific environmental monitoring and management practices adopted by the industry.
Module Parameters:	Access to relevant government, industry and community resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • identify environmental hazards and issues relevant to one of Alberta's energy or mineral industries	*Assessment of student achievement should be based on:* • given a specific energy or mineral industry in Alberta: – identifying a range of current environmental hazards/issues of relevance to the industry – gathering and reporting data regarding a specific environmental hazard – preparing a flow chart that outlines an environmental planning process that might be used to address one environmental concern. *Assessment Tool* *Assessment Criteria: Flow Charts, ENMFLO* *Lab Investigations: Intermediate Level, ENMLAB-2* *Standard* *Identify five environmental hazards/issues; conduct lab investigations on one environmental hazard to a standard of 2 on the rating scale; complete a flow chart of the planning process to a standard of 2 on the rating scale*	30

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• describe environmental policies and legislation that influence operations within an energy or mineral industry	• completing a research project on environmental policies and legislation that influence operations within an energy or mineral industry. Research to address: – specific legislative policies/guidelines that influence industry operations – construction and operating approvals required by the industry – strategies for public involvement in environmental planning and policy making – proposals for new policy/guidelines (or changes to existing policy) regarding an environmental concern. *Assessment Tool* *Research Process: Environmental Policies and Guidelines, ENM2100–1* *Standard* *Complete all components of research to a standard of 2 on the rating scale*	20
• explain environmental monitoring and management practices conducted by an energy or mineral industry	• a presentation or report that describes environmental monitoring and management practices conducted by an energy or mineral industry. Presentation/report to address: – goals and techniques of environmental monitoring – operating practices that address specific legislative requirements – components of land management – techniques used in waste management – applications of recycling systems. *Assessment Tool* *Presentations/Reports: Intermediate Level, ENMPRE–2* *Standard* *Achieve a minimum rating of 2 on the rating scale for Presentations/Reports*	40

MODULE ENM2100: ENVIRONMENTAL SAFETY (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• describe career opportunities relevant to environmental assessment and management	• completing a research project on one or more career opportunities in environmental assessment and management. *Assessment Tool* *Career Search: Intermediate Level, ENMCAR–2* *Standard* *Conduct research to a standard of 2 on the rating scale*	10
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Environmental Hazards	• identify environmental hazards relevant to an energy or mineral industry; e.g.: – air and water pollution – blowouts, spills and fires – emission of sulphur dioxide, carbon dioxide and nitrogen oxide – noise level – disposal of waste – land disturbance – degradation of wildlife habitat	Research hazards relevant to the Alberta context. For example, a number of factors minimize the formation and effects of sulphur dioxide in Alberta.
	• research current theories regarding: – global climate change and the emission of greenhouse gases – acid deposition and the burning of fossil fuels – the effects of chemical spills on food chains	Gather information using a variety of current sources (e.g., talk to specialists, search the Internet). Distinguish between facts and theories.
	• collect and report data on a specific environmental hazard	

Concept	Specific Learner Expectations	Notes
Environmental Hazards (continued)	*The student should:* • explain how specific environmental concerns relevant to one of Alberta's energy or mineral industries are addressed through the process of environmental planning.	Explain applications of environmental planning in: • land use management • waste management • spill containment/ recovery • maintaining air and water quality • rehabilitation and reclamation.
Policy and Legislation	• explain how industry and government work together to resolve environmental concerns	
	• research provincial and federal legislation regarding protection of the environment	Research the intent/ function of the *Environmental Protection Enhancement Act*.
	• identify specific legislative requirements that relate to operations within an energy or mineral industry	Discuss specific requirements of industry with respect to: • exploration • recovery/production • processing/refining • distribution.
	• describe construction and operating approvals required for specific operations • outline strategies for public involvement in environmental law making	Cite local examples of public involvement in persuading government to act on an environmental issue; e.g.: • Friends of the Oldman River Association • Alberta Wilderness Society.
	• propose changes to existing legislation or suggest new legislation regarding an environmental concern; e.g.: – sulphur dioxide/carbon dioxide emissions – water treatment – toxic waste management.	Request pamphlets from the Canadian Environmental Network. Research the *Federal Green Plan*.

MODULE ENM2100: ENVIRONMENTAL SAFETY (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Monitoring and Management Practices	• describe the goals and techniques of environmental monitoring within an energy or mineral industry	For example: • environmental audits • impact assessments.
	• explain operating practices and guidelines within the industry that relate to specific legislative requirements	
	• describe major aspects of land management within the industry	Investigate land management practices with respect to: • land acquisition • soils engineering • waste management • abandonment and reclamation.
	• research spill containment and recovery techniques	Gather information on: • spill equipment and usage • spill site assessment • contingency planning.
	• describe the mandates and responsibilities of association, industry and government organizations in spill control	
	• explain the planning process for pipeline facilities	Consider: • route selection • public consultation • permits/approvals • impact assessment • topsoil/timber salvage • reclamation techniques.
	• research theories and techniques relevant to waste management within the industry	For example: • treatment • disposal.
	• research current and emerging technologies that address environmental issues and promote sustainable development within the industry.	Possible research topics: • reduction of emissions, odours and noise • water treatment and purification • sulphur recovery • efficient use of energy • recycling systems.

MODULE ENM2100: ENVIRONMENTAL SAFETY (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Career Opportunities	• research careers and the range of occupational opportunities relevant to environmental management and safety; e.g.: – science and research – industry – government – legal and consulting	Plan for individual/group research and presentations that address: • job description • employment market • education/training • wage expectations. Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development).
	• evaluate current employment opportunities based on employment statistics	See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.
	• research trends in environmental monitoring and management, and future career opportunities.	Arrange/facilitate: • information interviews • work study/experience • job shadowing.

MODULE CURRICULUM AND ASSESSMENT STANDARDS:

SECTION F: ADVANCED LEVEL

The following pages define the curriculum and assessment standards for the advanced level of Energy and Mines.

> Advanced level modules demand a higher level of expertise and help prepare students for entry into the workplace or a related post-secondary program.

Module ENM3010: Energy & the Environment F.3
Module ENM3020: Conventional Oil/Gas 2 (Recovery & Production) F.9
Module ENM3030: Oil Sands/Heavy Oil/Coal 2 (Recovery & Production) F.15
Module ENM3040: Metals/Nonmetals 2 (Recovery & Production) F.21
Module ENM3050: Sustainable Energy (The Power & Potential) F.27
Module ENM3060: Petrochemicals F.33
Module ENM3070: Industrial Materials (Primary Manufacturing) F.41
Module ENM3080: Market Basics & Trends F.49
Module ENM3090: Energy Designs/Systems 2 (Practical Applications) F.55
Module ENM3100: Integrated Resource Management (Balancing Needs) F.59

MODULE ENM3010: ENERGY & THE ENVIRONMENT

Level: Advanced

Theme: Social and Cultural Perspectives

Prerequisite: None

Module Description: Students assess the social, economic and environmental benefits and costs of resource development, and demonstrate personal and shared actions that foster energy conservation and environmental stewardship.

Module Parameters: Access to relevant government, industry and community resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• describe the social, economic and environmental significance of energy development	• a presentation or report describing the social, economic and environmental significance of an energy development. Presentation/report to address: – social, economic and environmental factors affecting the development – actions taken by industry and government to address social, economic and/or environmental concerns – public consultation procedures established to respond to concerns regarding the development. *Assessment Tool* *Presentations/Reports: Advanced Level, ENMPRE–3* *Standard* *Achieve a minimum rating of 3 on the rating scale for presentations/reports*	30
• plan and implement a strategy for personal action that fosters an environmentally sensitive lifestyle	• conducting an audit of personal energy use within the home and community. *Assessment Tool* *Task Checklist: Conducting an Energy Use Audit, ENM3010–1* *Standard* *Complete all tasks on the checklist to a standard of 3 on the rating scale*	30

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MODULE ENM3010: ENERGY & THE ENVIRONMENT (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:* • maintaining a journal of lifestyle practices that affect an energy resource, inferences regarding the potential impact of each practice on the resource, and ideas for environmental citizenship. *Assessment Tool* *Reflection Guide for Environmental Responsibility/Citizenship, ENMREF* *Guide to Inferences: Personal Impact on Resources, ENM3010–2* *Standard* *Complete 10 journal entries; address criteria for reflection to a standard of 3 on the rating scale* • developing, implementing and assessing a personal action strategy for promoting energy conservation and an environmentally sensitive lifestyle. *Assessment Tool* *Assessment Criteria: Proposal for Environmental Action, ENMPRO* *Standard* *Develop, implement and assess the strategy to a standard of 3 on the rating scale*	
• **plan and implement a group; e.g., class, school, community, action campaign that fosters environmental awareness, energy conservation and energy efficiency**	• conducting a cost-benefit analysis of an energy saving technology. *Assessment Tool* *Task Checklist: Conducting a Cost-Benefit Analysis, ENM3010–3* *Standard* *Complete all tasks on the checklist to a standard of 3 on the rating scale* • given a current community issue regarding energy conservation, energy efficiency and/or lifestyle choices, negotiating and debating the issue while assuming the role of one or more stakeholder groups. *Assessment Tool* *Negotiation and Debate: Advanced Level, ENMNEG–3* *Standard* *Address criteria in negotiation/debate to a standard of 3 on the rating scale*	30

MODULE ENM3010: ENERGY & THE ENVIRONMENT (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:* • developing, implementing and assessing a classroom, school or community action campaign that fosters environmental awareness and energy conservation. *Assessment Tool* *Assessment Criteria: Proposal for Environmental Action, ENMPRO* *Standard* *Develop, implement and assess the strategy to a standard of 3 on the rating scale*	
• **explain career opportunities relevant to environmental management**	• completing a research project on one or more career opportunities in environmental management. *Assessment Tool* *Career Search: Advanced Level, ENMCAR–3* *Standard* *Conduct research to a standard of 3 on the rating scale*	10
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Environmental Significance	*The student should:* • describe the social, economic and environmental significance of an energy development; e.g.: – a hydro dam – an oil sands/coal development project • analyze relationships between an energy development and the environment	Investigate local developments; e.g.: • Keephills • Brazeau/Bighorn Dams • Fort McMurray oil sands. Research environmental issues resulting from: • greenhouse gases • acid deposition • habitat destruction • resource depletion.

Concept	Specific Learner Expectations	Notes
Environmental Significance (continued)	*The student should:* • describe actions taken by industry to reduce or eliminate environmental impacts of an energy development	How effective are current: • development practices? • reclamation technologies? • environmental monitoring procedures?
	• identify government policy and regulation at provincial and national levels intended to respond to social, economic and environmental concerns regarding an energy development • describe public consultation procedures and trade-offs that respond to social, economic and environmental concerns.	Policies/programs intended to foster a sustainable energy future usually focus on: • using less • finding alternative sources.
Strategy for Personal Action	• conduct an energy audit by maintaining a log of personal energy use for a period of several days	Plan for student-directed projects. Encourage students to express personal views and values.
	• distinguish among needs and wants as reflected through the energy audit	Plan for: • student debates • negotiation • consensus building.
	• evaluate the impact of personal energy use and lifestyle factors on the environment	Identify 10 or more personal actions and their consequences for the environment.
	• describe and implement a strategy to ensure an environmentally sensitive lifestyle	Brainstorm proposals for decreasing personal energy use.
	• evaluate the social, economic and environmental consequences of implementing the strategy	Evaluate proposals on the basis of effectiveness and practicality. Establish and implement priority actions.
	• revise the strategy according to environmental, social and economic outcomes.	Debate the benefits and costs of outcomes. Review and adjust the action plan.

Concept	Specific Learner Expectations	Notes
	The student should:	
Group Action Campaign	• identify and assess opportunities for reducing environmental impacts of energy use within the classroom, school and/or community	Conduct a cost-benefit analysis of an energy-saving technology; e.g.: • microwave ovens • fluorescent bulbs.
	• identify obstacles to group action to reduce environmental impacts	Develop a marketing campaign to increase public awareness.
	• plan and implement a classroom, school and/or community campaign that fosters environmental awareness and energy conservation	Establish goals and plan the campaign. As time permits, conduct the campaign and assess results.
	• identify constructive ways in which individuals can influence group decisions that affect energy consumption and the environment	For example: • voting • lobbying • seeking office • supporting compatible interest groups.
	• design a social, economic and/or environmental impact assessment and consultation process for a proposed energy project.	Use a team approach. Encourage students to assume the role of owner, intervenor, lobbyist, etc. Discuss the importance of planning for a new project or the expansion of an existing project.
Career Opportunities	• research careers and the range of occupational opportunities in environmental management; e.g.: – engineering – technical and support services – general consulting	Plan for individual/group research and presentations that address: • job description • employment market • education/training • wage expectations. Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development).
	• evaluate current employment opportunities based on employment statistics	See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.

MODULE ENM3010: ENERGY & THE ENVIRONMENT (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Career Opportunities (continued)	• research trends in environmental management, and future career opportunities.	Arrange/facilitate: • information interviews • work study/experience • job shadowing.

MODULE ENM3020: CONVENTIONAL OIL/GAS 2 (RECOVERY & PRODUCTION)

Level:	Advanced
Theme:	Technology and Applications
Prerequisite:	ENM2020 Conventional Oil/Gas 1 (Resource Exploration)
Module Description:	Students examine specific recovery and production techniques within the context of a conventional oil and/or gas industry, and they explain related career opportunities.
Module Parameters:	Access to conventional oil/gas recovery and production industry. Access to a science laboratory. This module requires off-campus learning experiences and should be combined with relevant work study, work experience and/or modules from the Career Transitions strand; consultation with the work-site supervisor will ensure that relevant safety considerations are addressed. See the *Off-Campus Education Guide for Administrators, Counsellors and Teachers* (Alberta Education) for further information regarding off-campus learning.
Supporting Module:	CTR2210 Workplace Safety (Practices) [Career Transitions Strand]; recommended for off-campus learning Students must have a general knowledge of potential hazards and accepted safety practices relevant to specific recovery and production sites prior to engaging in off-campus learning experiences. See Planning for Instruction in Section C of this Guide for further information regarding student safety.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • describe techniques used to complete and service a conventional oil or gas well	*Assessment of student achievement should be based on:* • a presentation or report that describes and illustrates steps taken to prepare a successful oil or gas well for production. Report to address: – installation of production casing and tubing – cementing – installation of wellhead – well perforation – well stimulation treatments. *Assessment Tool* *Presentations/Reports: Advanced Level, ENMPRE–3* *Standard* *Achieve a minimum rating of 3 on the rating scale for Presentations/Reports*	40

MODULE ENM3020: CONVENTIONAL OIL/GAS 2 (RECOVERY & PRODUCTION)
(continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:* • through laboratory and/or field-based investigations: – identifying applications of principles of science and technology in well production operations – comparing the principles and processes involved in naturally flowing wells with those depending on recovery by artificial lift. *Assessment Tool* *Lab Investigations: Advanced Level, ENMLAB–3* *Observation Checklist for Field-based Investigations, ENMOBS* *Standard* *Conduct lab investigations to a standard of 3 on the rating scale and/or complete all sections of the observation checklist for field-based investigations* • a summary of environmental assessment and management practices conducted by industry throughout recovery and production operations. *Assessment Tool* *Presentations/Reports: Advanced Level, ENMPRE–3* *Standard* *Achieve a minimum rating of 3 on the rating scale for Presentations/Reports* • a concept test in which the student demonstrates knowledge of well-site production equipment and surface facilities, and their function in recovery, production and environmental/workplace safety. *Assessment Tool* Energy Sources/Applications/Alternatives *(Instructor's Manual)* *Standard* *Response indicating 60% mastery*	

MODULE ENM3020: CONVENTIONAL OIL/GAS 2 (RECOVERY & PRODUCTION)
(continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **explain applications of enhanced oil recovery technology in maximizing recovery rates for conventional oil or gas**	• completing a research project on secondary and tertiary methods of enhanced oil recovery. Research to address: – water and gas injection – pumping technology – miscible flooding – steam injection – fireflooding – horizontal drilling. *Assessment Tool* *Research Process: Enhanced Oil Recovery, ENM3020–1* *Standard* *Complete all components of research to a standard of 3 on the rating scale*	20
• **describe field gathering facilities and distribution systems used in the conventional oil or gas industry**	• a flow chart that traces the movement of a conventional oil or gas commodity from well-site to market (or refinery). Flow chart to illustrate (as appropriate): – separation facilities – field storage techniques – distribution networks – pipeline systems – pump/compressor stations. *Assessment Tool* *Assessment Criteria: Flow Charts, ENMFLO* *Standard* *Complete the flow chart to a standard of 3 on the rating scale*	20
• **explain career opportunities relevant to the recovery and production sector of the conventional oil and gas industry**	• completing a research project on technical, professional and/or labour-based careers in the recovery and production sector of conventional oil and gas industry. *Assessment Tool* *Career Search: Advanced Level, ENMCAR–3* *Standard* *Conduct research to a standard of 3 on the rating scale*	20

MODULE ENM3020: CONVENTIONAL OIL/GAS 2 (RECOVERY & PRODUCTION) (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: - **demonstrate basic competencies.**	*Assessment of student achievement should be based on:* - observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Well Completion and Servicing	• outline steps that are taken to prepare a successful oil or gas well for production: – installation of production casing and tubing – cementing – installation of wellhead – well perforation	Discuss safety considerations relevant to the well-site; e.g.: • first aid • clothing and equipment • government/industry regulation • lifting/hoisting techniques.
	• describe well-site production equipment and surface facilities and their function in production, maintenance and safety; e.g.: – service rig – flare line – accumulators	Identify general parts of a service rig and accompanying equipment; e.g.: • blowout preventers • rig tank • tongs • wellhead.
	• distinguish between natural flowing wells and wells that depend upon artificial lift	Encourage students to make links with concepts studied in the core science program.
	• explain well stimulation treatments used to ensure underground movement of hydrocarbons to the well bore	For example, • acidizing • fracturing.
	• describe methods used to control well production	
	• explain environmental assessment and management practices conducted by industry throughout recovery and production operations	Research environmental standards and the enforcement of safe operating procedures throughout recovery and production activities.

MODULE ENM3020: CONVENTIONAL OIL/GAS 2 (RECOVERY & PRODUCTION)
(continued)

Concept	Specific Learner Expectations	Notes
Well Completion and Servicing (continued)	*The student should:* • describe technological advances used to address environmental concerns throughout recovery and production	Gather information regarding practices followed to maintain environmental standards; e.g.: • directional wells • land reclamation • control of sulphur emissions.
	• research well completion practices and production equipment used in frontier operations.	For example: • arctic • off-shore.
Enhanced Oil Recovery	• identify factors that determine the portion of oil in a reservoir that can be produced naturally through primary recovery methods; e.g.: – density and viscosity of the oil – porosity and permeability of the rock – pressure in the reservoir	Cite reasons for making production as efficient as possible. Average recovery in light oilfields is about 30% of the original oil. The remaining 70% cannot be recovered economically with existing technology.
	• explain applications of infill drilling to improve oil or gas recovery rates	Research the use of directional wells for infill drilling.
	• explain secondary methods of enhanced oil recovery	For example: • water and gas injection • pumping technology.
	• explain tertiary methods of enhanced oil recovery	For example: • miscible flooding • steam injection • fireflooding • horizontal drilling.
	• identify factors that influence the life of an oil and/or gas well	
	• describe techniques used to estimate recoverable oil and gas reserves	Compare and contrast the concepts of "proved reserve," "probable reserve" and "established reserve."
	• describe future sources of oil and gas supplies; e.g.: – unrecovered oil in existing reservoirs – frontier production – oil sands.	Discuss factors that determine estimates of recoverability and producibility; e.g.: • reservoir characteristics • economic considerations • regulatory limitations.

Concept	Specific Learner Expectations	Notes
	The student should:	
Gathering and Distribution	• describe well-site and satellite facilities used for dehydration, separation, heating and measurement processes	For example: • surface • underground.
	• describe different types of field storage facilities	For example: • pipeline systems • tankers and barges.
	• research distribution networks used to move conventional oil or gas from well-site to market (or refinery)	For example: • rail systems • trucking systems.
	• describe the layout of a pipeline system used for transporting conventional oil or gas	For example: • gathering lines • trunk lines • gas transmission systems.
	• explain the function of pump and compressor stations in moving oil or gas along transmission lines.	Research electronic inspection devices used to detect potential problems such as faulty welds, dents, cracks or corrosion.
Career Opportunities	• research careers and the range of occupational opportunities within the recovery and production sector of a mineral industry; e.g.: – earth science – engineering – technical and support services – apprenticeship trades – environmental management	Plan for individual/group research and presentations that address: • job description • employment market • education/training • wage expectations. Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development).
	• evaluate current employment opportunities based on employment statistics	See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.
	• research recovery and production trends and future career opportunities.	Arrange/facilitate: • information interviews • work study/experience • job shadowing.

MODULE ENM3030: OIL SANDS/HEAVY OIL/COAL 2 (RECOVERY & PRODUCTION)

Level:	Advanced
Theme:	Technology and Applications
Prerequisite:	ENM2030 Oil Sands/Heavy Oil/Coal 1 (Resource Exploration)
Module Description:	Students examine specific recovery and production techniques within the context of Alberta's oil sands, heavy oil or coal deposits; and they explain related career opportunities.
Module Parameters:	Access to industry involved in the recovery and production of nonconventional hydrocarbon resources. Access to a science laboratory. This module requires off-campus learning experiences and should be combined with relevant work study, work experience and/or modules from the Career Transitions strand; consultation with the work-site supervisor will ensure that relevant safety considerations are addressed. See the *Off-Campus Education Guide for Administrators, Counsellors and Teachers* (Alberta Education) for further information regarding off-campus learning.
Supporting Module:	CTR2210 Workplace Safety (Practices) [Career Transitions Strand]; recommended for off-campus learning Students must have a general knowledge of potential hazards and accepted safety practices relevant to specific recovery and production sites prior to engaging in off-campus learning experiences. See Planning for Instruction in Section C of this Guide for further information regarding student safety.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • describe techniques used to recover a nonconventional hydrocarbon resource	*Assessment of student achievement should be based on:* • a presentation or report that describes and illustrates: – extraction, processing and transportation infrastructures necessary for the recovery and production of bitumen, heavy oil or coal – specific techniques used to extract a nonconventional hydrocarbon, including surface mining, underground mining and/or in situ ("in place") techniques – environmental assessment and management practices conducted by industry throughout recovery and production operations. *Assessment Tool* *Presentations/Reports: Advanced Level, ENMPRE–3* *Standard* *Achieve a minimum rating of 3 on the rating scale for Presentations/Reports*	50

MODULE ENM3030: OIL SANDS/HEAVY OIL/COAL 2 (RECOVERY & PRODUCTION) (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
	• through laboratory and/or field-based investigations, identifying applications of principles of science and technology involved in separating, cleaning and/or upgrading a nonconventional hydrocarbon. *Assessment Tool* *Lab Investigations: Advanced Level, ENMLAB–3* *Observation Checklist for Field-based Investigations, ENMOBS* *Standard* *Conduct lab investigations to a standard of 3 on the rating scale and/or complete all sections of the observation checklist for field-based investigations*	
	• a concept test in which the student demonstrates knowledge of surface and underground equipment used in resource extraction. *Assessment Tool* Energy Sources/Applications/Alternatives *(Instructor's Manual)* *Standard* *Response indicating 60% mastery*	
• **describe field gathering facilities and distribution systems used in the oil sands, heavy oil or coal industry**	• a flow chart that traces the movement of nonconventional hydrocarbon from recovery site to market (or refinery). Flow chart to illustrate (as appropriate): – separation, cleaning and/or upgrading facilities – field storage techniques – distribution networks – pipeline systems. *Assessment Tool* *Assessment Criteria: Flow Charts, ENMFLO* *Standard* *Complete the flow chart to a standard of 3 on the rating scale*	10

MODULE ENM3030: OIL SANDS/HEAVY OIL/COAL 2 (RECOVERY & PRODUCTION) (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• explain current and emerging applications of technology in maximizing recovery of heavy oil, bitumen or coal in Alberta	• completing a research project on techniques used to maximize resource recovery. Research to address: – factors that affect recovery potential for an oil sand, heavy oil or coal deposit – applications of enhanced recovery technology, including horizontal drilling and innovations in extraction and/or separation – techniques used to estimate recoverable deposits of bitumen, heavy oil or coal. *Assessment Tool* *Research Process: Enhanced Recovery of Nonconventional Hydrocarbons, ENM3030–1* *Standard* *Complete all components of research to a standard of 3 on the rating scale*	20
• explain career opportunities relevant to the recovery and production sector of a nonconventional hydrocarbon industry	• completing a research project on technical, professional and/or labour-based careers within the recovery and production sector of a nonconventional hydrocarbon industry. *Assessment Tool* *Career Search: Advanced Level, ENMCAR–3* *Standard* *Conduct research to a standard of 3 on the rating scale*	20
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

MODULE ENM3030: OIL SANDS/HEAVY OIL/COAL 2 (RECOVERY & PRODUCTION) (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Recovery Techniques	• describe infrastructures necessary in the recovery and production of a nonconventional hydrocarbon resource: – extraction – processing – transportation	Discuss safety considerations relevant to the recovery-site; e.g.: • first aid • clothing and equipment • government/industry regulations • lifting/hoisting techniques.
	• research techniques used to extract the hydrocarbon; e.g.:	
	– surface mining	For example, strip, open-pit.
	– underground mining	For example, shaft, slope.
	– in situ ("in place") techniques	For example, steam injection, solvent injection, firefloods.
	• describe surface and underground equipment used in resource extraction	Research the use of: • heavy machinery (including excavators, scrapers, bulldozers and draglines) • blasting, drilling and cutting equipment • augers, conveyor belts and trucks • hand tools and safety equipment.
	• research technologies used to process the hydrocarbon: – separating – cleaning – upgrading	Encourage student to make links with concepts studied in the core science courses.
	• explain environmental assessment and management practices conducted by industry throughout recovery and production operations	Research environmental standards and the enforcement of safe operating procedures throughout recovery and production activities.

MODULE ENM3030: OIL SANDS/HEAVY OIL/COAL 2 (RECOVERY & PRODUCTION) (continued)

Concept	Specific Learner Expectations	Notes
Recovery Techniques (continued)	*The student should:* • describe technological advances used to address environmental concerns throughout recovery and production	Identify specific environmental problems related to recovery/ production. Research potential solutions to the problems identified; e.g.: • tailing ponds • sulphur emission • water drawdown.
	• describe basic reclamation activities undertaken by industry.	Research and discuss: • recovery/production area restoration • strip-mine restoration.
Gathering and Distribution	• describe recovery-site and satellite facilities used for separation, cleaning and upgrading processes • describe different types of field storage facilities	Identify challenges associated with the gathering and transmission of bitumen and heavy oil, and technologies developed to assist in these processes.
	• research distribution networks used to move bitumen, heavy oil or coal from recovery-site to market (or refinery).	For example, • pipeline systems • tankers and barges • rail and trucking systems.
Applications of Technology	• explain the economic, social and environmental significance of Alberta's nonconventional hydrocarbon resources	Subscribe to *Rock Chips* (a newsletter published by the Alberta Geological Survey).
	• identify factors that affect the recovery potential for heavy oil, oil sands or coal deposits	Explain how recovery potential may be affected by: • nature and depth of the overburden • density and viscosity of oil • porosity and permeability of rock structures • economic viability.

MODULE ENM3030: OIL SANDS/HEAVY OIL/COAL 2 (RECOVERY & PRODUCTION) (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Applications of Technology (continued)	• explain technologies used to maximize resource recovery; e.g.: – horizontal drilling – extraction and separation processes	Discuss reasons for making production as efficient as possible.
	• describe special drilling techniques, core description and geophysical logging for oil sands deposits	
	• research public and private agencies responsible for developing new technology to assist in the recovery of nonconventional hydrocarbon resources	For example, • Alberta Research Council • Alberta Oil Sands Technology and Research Authority • Office of Coal Research and Technology.
	• describe techniques used to estimate Alberta's recoverable heavy oil, bitumen and coal.	Compare and contrast the concepts of "proved reserve," "probable reserve" and "established reserve."
Career Opportunities	• research careers and the range of occupational opportunities within the recovery and production sector of a nonconventional hydrocarbon industry; e.g.: – earth science – engineering – technical and support services – apprenticeship trades – environmental management	Plan for individual/group research and presentations that address: • job description • employment market • education/training • wage expectations. Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development).
	• evaluate current employment opportunities based on employment statistics	See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.
	• research recovery and production trends and future career opportunities.	Arrange/facilitate: • information interviews • work study/experience • job shadowing.

MODULE ENM3040: METALS/NONMETALS 2 (RECOVERY & PRODUCTION)

Level: Advanced

Theme: Technology and Applications

Prerequisite: ENM2040 Metals/Nonmetals 1 (Resource Exploration)

Module Description: Students examine specific recovery and production techniques within the context of a metallic and/or nonmetallic mineral deposit, and they explain related career opportunities.

Note: Industry often refers to a third category of minerals called "structural materials"; i.e., minerals used primarily in construction, including sand and gravel, decorative and building stone, cement, clay and limestone. Modules ENM2040 and ENM3040 include structural materials within the broader category of nonmetallic minerals.

Module Parameters: Access to industry involved in the recovery and production of metallic and/or non-metallic minerals.

Access to a science laboratory.

This module requires off-campus learning experiences and should be combined with relevant work study, work experience and/or modules from the Career Transitions strand; consultation with the work-site supervisor will ensure that relevant safety considerations are addressed.

See the *Off-Campus Education Guide for Administrators, Counsellors and Teachers* (Alberta Education) for further information regarding off-campus learning.

Supporting Module: CTR2210 Workplace Safety (Practices) [Career Transitions Strand]; recommended for off-campus learning

Students must have a general knowledge of potential hazards and accepted safety practices relevant to specific recovery and production sites prior to engaging in off-campus learning experiences. See Planning for Instruction in Section C of this Guide for further information regarding student safety.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • **describe techniques used to recover metallic and nonmetallic commodities from mineral deposits**	*Assessment of student achievement should be based on:* • a presentation or report that describes and illustrates: – extraction, processing and transportation infrastructures necessary for the recovery of a commodity from a rock or mineral deposit – specific mining techniques used to extract a metallic or nonmetallic mineral, including placer mining, surface mining, underground mining and/or drilling/borehole mining – environmental assessment and management practices conducted by industry throughout recovery and production operations. *Assessment Tool* *Presentations/Reports: Advanced Level, ENMPRE–3* *Standard* *Achieve a minimum rating of 3 on the rating scale for Presentations/Reports* • through laboratory and/or field-based investigations, identifying applications of principles of science and technology involved in separating, cleaning and/or upgrading a metallic or nonmetallic mineral. *Assessment Tool* *Lab Investigations: Advanced Level, ENMLAB–3* *Observation Checklist for Field-based Investigations, ENMOBS* *Standard* *Conduct lab investigations to a standard of 3 on the rating scale and/or complete all sections of the observation checklist for field-based investigations* • a concept test in which the student demonstrates knowledge of surface and underground equipment used in resource extraction. *Assessment Tool* Exploring Manufacturing *(Instructor's Manual)* *Standard* *Response indicating 60% mastery*	50

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **describe field gathering facilities and distribution systems used in the mineral industry**	• a flow chart that traces the movement of a mineral commodity from recovery-site to market (or refinery). Flow chart to illustrate (as appropriate): – separation, cleaning and/or upgrading facilities – field storage techniques – distribution networks. *Assessment Tool* *Assessment Criteria: Flow Charts, ENMFLO* *Standard* *Complete the flow chart to a standard of 3 on the rating scale*	10
• **explain current and emerging applications of technology in enhancing recovery methods for mineral deposits**	• completing a research project on techniques used to maximize resource recovery. Research to address: – factors that affect the recovery potential for a mineral deposit – applications of enhanced recovery technology, including drilling and blasting techniques, rock bolting and screening machines, video technology and remote control, and innovations in separation technology – techniques used to estimate recoverable mineral deposits in Alberta. *Assessment Tool* *Research Process: Enhanced Mineral Recovery, ENM3040–1* *Standard* *Complete all components of research to a standard of 3 on the rating scale*	20
• **explain career opportunities relevant to the recovery and production sector of a mineral industry**	• conducting research on technical, professional and labour-based careers within the recovery and production sector of a mineral industry. *Assessment Tool* *Career Search: Advanced Level, ENMCAR–3* *Standard* *Conduct research to a standard of 3 on the rating scale*	20

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • demonstrate basic competencies.	*Assessment of student achievement should be based on:* • observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Recovery Techniques	• describe infrastructures necessary in the recovery of commodities from rock and mineral deposits – extraction – processing – transportation	Discuss safety considerations relevant to the recovery-site; e.g.: • first aid • clothing and equipment • government/industry regulation • lifting/hoisting techniques.
	• research basic techniques used to extract metallic and nonmetallic mineral deposits; e.g.: – placer mining – surface mining – underground mining – other extraction methods	Obtain a copy of *Edmonton Beneath Our Feet* from the Alberta Geological Survey. For example: • drilling • borehole mining.
	• describe surface and/or underground equipment used in resource extraction	Research the use of: • heavy machinery (e.g., excavators, scrapers, bulldozers and draglines) • blasting, drilling and cutting equipment • augers, conveyor belts and trucks • hand tools and safety equipment.
	• research technologies used to process a metallic, nonmetallic or structural mineral: – crushing/screening – separating/dressing – cleaning/roasting – upgrading/smelting	Encourage student to make links with concepts studied in the core science courses.

MODULE ENM3040: METALS/NONMETALS 2 (RECOVERY & PRODUCTION) (continued)

Concept	Specific Learner Expectations	Notes
Recovery Techniques (continued)	*The student should:* • explain environmental assessment and management practices conducted by industry throughout recovery and production operations	Research environmental standards and the enforcement of safe operating procedures throughout recovery and production activities.
	• describe technological advances used to address environmental concerns throughout recovery and production	Identify specific environmental problems related to recovery/production. Encourage students to propose solutions.
	• describe basic reclamation activities undertaken by industry.	Research and discuss: • recovery/production area restoration • strip-mine restoration.
Gathering and Distribution	• describe recovery-site and satellite facilities used for separation, cleaning and upgrading processes • describe different types of field storage facilities	Obtain the brochures *Aggregates* and *Aggregates and Our Environment* from the Alberta Sand and Gravel Association.
	• research distribution networks used to move metallic or industrial minerals from recovery-site to market (or refinery).	For example: • rail systems • trucking systems • tankers and barges.
Applications of Technology	• explain the current and potential significance of Alberta's mineral resources	Discuss the current and future economic, social and environmental significance.
	• identify factors that affect the recovery potential for a mineral deposit	Explain how recovery potential may be affected by: • depth of overburden • size and nature of the deposit • economic viability • environmental impact.

Concept	Specific Learner Expectations	Notes
	The student should:	
Applications of Technology (continued)	• explain applications of technology in enhanced recovery methods; e.g.: – drilling and blasting techniques – rock bolting and screening machines – video technology and remote control – innovations in separation technology	Discuss reasons for making production as efficient as possible. Subscribe to *Rock Chips* (a newsletter published by the Alberta Geological Survey).
	• identify methods used for the exploration of "hidden" or "blind" deposits	Discuss methods used both in existing mines and for new developments.
	• research public and private agencies responsible for developing new technology to assist in the recovery of Alberta's mineral resources	For example: • Alberta Research Council • National Research Council.
	• describe techniques used to estimate recoverable mineral deposits in Alberta.	Consider applications of: • computing techniques • assays • mathematical modelling.
Career Opportunities	• research careers and the range of occupational opportunities within the recovery and production sector of a mineral industry; e.g.: – earth science – engineering – technical and support services – apprenticeship trades – environmental management	Plan for individual/group research and presentations that address: • job description • employment market • education/training • wage expectations. Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development).
	• evaluate current employment opportunities based on employment statistics	See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.
	• research recovery and production trends and future career opportunities.	Arrange/facilitate: • information interviews • work study/experience • job shadowing.

MODULE ENM3050: SUSTAINABLE ENERGY (THE POWER & POTENTIAL)

Level: Advanced

Theme: Technology and Applications

Prerequisite: ENM2050 Renewable Energy Technology

Module Description: Students examine opportunities for planning renewable energy development and conserving conventional energy for its ideal use.

Module Parameters: Access to relevant government, industry and community resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • **identify alternatives and consequences associated with current issues involving energy supply and demand**	*Assessment of student achievement should be based on:* • analyzing two or more current issues regarding energy supply and demand at local and global levels. Analysis to address social, economic, environmental and technological perspectives. *Assessment Tool* *Issue Analysis: Energy Supply and Demand, ENM3050–1* *Standard* *Analyze each issue to a standard of 3 on the rating scale* • completing a research project on applications of renewable and nonrenewable energy technology in sustainable energy development. Research to address: – benefits and obstacles related to the use of renewables and nonrenewables – the role of alternative energy options, energy efficiency and conservation lifestyles in achieving sustainable energy development. *Assessment Tool* *Research Process: Sustainable Energy Development, ENM3050–2* *Standard* *Complete all components of research to a standard of 3 on the rating scale*	20

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MODULE ENM3050: SUSTAINABLE ENERGY (THE POWER & POTENTIAL) (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• describe the benefits and obstacles associated with demand-side energy management	• developing and implementing a demand-side energy management awareness and information campaign within the school and/or community. Campaign to include: – an outline of conservation and efficiency measures that can be implemented – promotional materials, including posters, handbills, videotaped commercials and/or information programs – a plan for action. *Assessment Tool* *Assessment Criteria: Energy Management Campaign, ENM3050–3* *Standard* *Develop and implement the campaign to a standard of 3 on the rating scale*	30
• present a plan for sustainable energy development	• developing and presenting a plan for sustainable energy development within one sector of society. Plan may be developed as a paper, display or video presentation, and should include: – goals, objectives and benefits of the development – development details, including site and technological requirements, processes and supply/distribution networks – a strategy for monitoring development outcomes and resolving potential conflicts/issues. *Assessment Tool* *Presentations/Reports: Advanced Level, ENMPRE–3* *Standard* *Develop and present the plan to a standard of 3 on the rating scale for Presentations/Reports*	30
• explain career opportunities relevant to energy planning and development	• completing a research project on one or more career opportunities in energy planning and development. *Assessment Tool* *Career Search: Advanced Level, ENMCAR–3* *Standard* *Conduct research to a standard of 3 on the rating scale*	20

MODULE ENM3050: SUSTAINABLE ENERGY (THE POWER & POTENTIAL) (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: - demonstrate basic competencies.	*Assessment of student achievement should be based on:* - observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Energy Supply and Demand	- examine social, economic and environmental perspectives regarding conventional energy supply	Discuss issues relevant to the development of conventional energy supplies; e.g.: - How much? - How fast? Consider trends regarding energy conservation, efficiency and "conservation lifestyles."
	- describe recent applications of technology in conventional energy development	Research technologies designed to: - improve recovery rates - lessen environmental impacts.
	- research forecasts regarding future energy supply and demand, and options for ensuring a sustainable energy future	Discuss/assess options such as: - using less - finding alternative sources.
	- describe applications of renewable energy in supplementing conventional energy sources.	Discuss current and/or emerging applications of renewable energy; e.g.: - domestic/industrial heating - transportation.

Concept	Specific Learner Expectations	Notes
	The student should:	
Demand-side Energy Management	• describe basic principles of demand-side energy management • evaluate benefits and obstacles associated with demand-side energy management	Demand-side management focuses attention on how energy is used; e.g.: • controlling need • levelling consumption • developing energy alternatives • saving conventional sources for their ideal use.
	• suggest advantages of demand-side energy management over supply-side energy management in planning future energy development	Consider factors such as: • energy efficiency and conservation • environmental quality • energy costs.
	• describe ways in which society can support and/or adapt to demand-side energy management; e.g.: – change people's habits to save energy and reduce waste – use design and technology to increase energy efficiency.	Discuss common barriers to demand-side management; e.g.: • lack of awareness of long-term benefits • low energy prices • lack of energy standards for buildings, vehicles, etc.
Sustainable Energy Development	• provide a definition and examples of sustainable energy development • suggest a rationale for sustainable energy development that addresses social, economic and environmental perspectives • compare the roles of renewable and nonrenewable technology in sustainable energy development	Contact the Pincher Creek Development and Information Centre (formerly the Southwest Alberta Renewable Energy Initiative) for current information on sustainable energy development in Alberta.
	• cite examples of sustainable energy path development that involve least-cost combinations and efficient use of both conventional and nonconventional energy sources	Sustainable energy path development involves matching the "quality" of the energy provided to the "quality" of the energy required.
	• propose changes in current social values and political structures that may facilitate sustainable energy development	Consider changes required in: • consumer practices • government policy • technology.

MODULE ENM3050: SUSTAINABLE ENERGY (THE POWER & POTENTIAL) (continued)

Concept	Specific Learner Expectations	Notes
Sustainable Energy Development (continued)	*The student should:* • develop and present a plan for sustainable energy path development that includes: – supply-side management solutions – demand-side management solutions	The plan might involve: • wind farms • photovoltaic development • geothermal development • hydrogen development • hydro development.
	• evaluate the plan on the basis of predicted social, economic and environmental consequences.	
Career Opportunities	• research careers and the range of occupational opportunities that involve energy planning and development e.g.: – engineering – technical and support services – environmental management	Plan for individual/group research and presentations that address: • job description • employment market • education/training • wage expectations. Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development).
	• evaluate current employment opportunities based on employment statistics	See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.
	• research trends in energy planning and development, and future career opportunities.	Arrange/facilitate: • information interviews • work study/experience • job shadowing.

MODULE ENM3060: PETROCHEMICALS

Level: Advanced

Theme: Technology and Applications

Prerequisite: ENM2060 Refining Hydrocarbons

Module Description: Students investigate the conversion of hydrocarbons into consumer products within a petrochemical industry, and they explain related career opportunities.

Module Parameters: Access to a petrochemical industry.

Access to a science laboratory.

This module requires off-campus learning experiences and should be combined with relevant work study, work experience and/or modules from the Career Transitions strand; consultation with the work-site supervisor will ensure that relevant safety considerations are addressed.

See the *Off-Campus Education Guide for Administrators, Counsellors and Teachers* (Alberta Education) for further information regarding off-campus learning.

Supporting Module: CTR2210 Workplace Safety (Practices) [Career Transitions Strand]; recommended for off-campus learning

Students must have a general knowledge of potential hazards and accepted safety practices relevant to specific processing sites prior to engaging in off-campus learning experiences. See Planning for Instruction in Section C of this Guide for further information regarding student safety.

MODULE ENM3060: PETROCHEMICALS (continued)

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• identify consumer and industrial products made available through petrochemical processes	• identifying and describing: – petroleum feedstocks used in the petrochemical industry – primary groups of petrochemicals obtained from petroleum feedstocks – intermediate and finished products manufactured from petrochemicals. *Assessment Tool* Our Petroleum Challenge: Into the 21st Century *(page 58), Petroleum Communication Foundation* *Standard* *Identify major classes of petroleum feedstocks, primary petrochemicals obtained from each feedstock, and two intermediate/finished products manufactured from each petrochemical*	10
• explain how petroleum molecules are sorted, broken apart and reassembled at petrochemical plants	• conducting laboratory and/or field-based investigations that examine: – the sorting of petroleum molecules through fractional distillation – the role of temperature, pressure and catalytic reaction in the distillation process. *Assessment Tool* *Lab Investigations: Advanced Level, ENMLAB–3* *Observation Checklist for Field-based Investigations, ENMOBS* *Standard* *Conduct lab investigations to a standard of 3 on the rating scale and/or complete all sections of the observation checklist for field-based investigations*	30

MODULE ENM3060: PETROCHEMICALS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
	• completing a research project on applications of principles of science and technology in one petrochemical processing industry. Research will examine how petroleum molecules are broken apart, reassembled and/or blended. *Assessment Tool* *Research Process: Petrochemical Processing, ENM3060–1* *Standard* *Complete all components of research to a standard of 3 on the rating scale*	
• **describe technologies used to manufacture a petrochemical product**	• a flow chart that outlines basic inputs, processes and technologies involved in the manufacture of a petrochemical product. *Assessment Tool* *Assessment Criteria: Flow Charts, ENMFLO* *Standard* *Complete the flow chart to a standard of 3 on the rating scale*	40
	• a summary of environmental assessment and management practices conducted by industry throughout manufacturing operations. *Assessment Tool* *Presentations/Reports: Advanced Level, ENMPRE–3* *Standard* *Achieve a minimum rating of 3 on the rating scale for Presentations/Reports*	
• **explain career opportunities relevant to a petrochemical industry**	• conducting research on technical, professional and labour-based careers within the petrochemical industry. *Assessment Tool* *Career Search: Advanced Level, ENMCAR–3* *Standard* *Conduct research to a standard of 3 on the rating scale*	20

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: - **demonstrate basic competencies.**	*Assessment of student achievement should be based on:* - observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Petrochemical Products	- describe the social, economic and environmental significance of Canada's petrochemical industries	Prepare a poster/display of consumer and industrial products (or services) derived from the petrochemical industry.
	- identify and describe important petroleum feedstocks used in the petrochemical industry	Research the use of: • crude oil • natural gas • ethane, propane and butane • naptha gas oil.
	- identify the primary groups of petrochemicals obtained from petroleum feedstocks and subsequently processed into intermediate and finished products	For example: • methanol • benzene, toluene and xylene • butadiene and butylene • propylene • ethylene.
	- identify and describe intermediate and finished products that are derived from petrochemicals	For example: • plastics • synthetic clothing fibres • medicines • paints • detergents • fertilizers and pesticides.

MODULE ENM3060: PETROCHEMICALS (continued)

Concept	Specific Learner Expectations	Notes
Petrochemical Products (continued)	*The student should:* • identify and describe major consuming industries for Canada's petrochemical products.	Research the use of petrochemicals in: • forest products • transportation • textiles • electronics • cosmetics and pharmaceuticals • agriculture.
Changing Petroleum Molecules	• describe petroleum molecules as strings and rings of carbon and hydrogen atoms • construct models of simple and more complex hydrocarbon molecules • research basic fractionating processes used to sort petroleum molecules • explain how petroleum molecules are broken apart, reassembled and blended through the processes of cracking, polymerization and isomerization • research the role of temperature, pressure and catalysts in sorting and rearranging petroleum molecules.	For example: • methane • paraffin. Assemble and use a simple fractionating column to separate and sort molecules through the process of fractional distillation. Conduct laboratory investigations. Encourage students to relate experimental outcomes to studies in the core science program.
Refining and Manufacturing Processes	• research the conversion of a hydrocarbon into a petrochemical product within one of Canada's petrochemical industries; e.g.: – plastic – polyethylene – detergent – fertilizer • identify specific hydrocarbon feedstocks used in the manufacturing process • describe techniques employed to sort, break apart, reassemble and/or blend petroleum molecules	Distinguish between the refining of crude oil (ENM2060) and the manufacture of petrochemicals (ENM3060). For example, • fractionating • cracking • polymerization • isomerization.

MODULE ENM3060: PETROCHEMICALS (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Refining and Manufacturing Processes (continued)	• construct a flow chart outlining the path of a hydrocarbon from recovery-site to finished product	Draw/construct a simplified model of a petrochemical facility.
	• explain applications of electronic equipment and computer technology in monitoring and controlling manufacturing operations	
	• describe storage facilities and distribution systems within the industry, and their impact on industry location and product costs	Construct flow charts that illustrate storage and distribution systems.
	• explain environmental assessment and management practices conducted by industry throughout manufacturing operations	Research environmental standards and the enforcement of safe operating procedures throughout manufacturing operations.
	• describe industry initiatives that respond to environmental concerns	For example: • waste treatment • emission control.
	• describe industry initiatives that address occupational health and safety requirements	For example: • odour scrubbers • noise suppressants • water purification.
	• describe industry initiatives in re-refining and reprocessing to ensure a life-cycle approach to chemicals management.	Research the development of recycled materials for specific environments and applications.

MODULE ENM3060: PETROCHEMICALS (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Career Opportunities	• research careers and the range of occupational opportunities within the petrochemical industry; e.g.: – engineering – technical and support services – apprenticeship trades – environmental management	Plan for individual/group research and presentations that address: • job description • employment market • education/training • wage expectations.
	• explain the personnel structure within a petrochemical industry	Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development).
	• evaluate current employment opportunities based on employment statistics	See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.
	• research trends in the refining and manufacturing of petroleum-based products, and future career opportunities.	Arrange/facilitate: • information interviews • work study/experience • job shadowing.

MODULE ENM3070: INDUSTRIAL MATERIALS (PRIMARY MANUFACTURING)

Level: Advanced

Theme: Technology and Applications

Prerequisite: ENM2070 Refining Rocks & Minerals

Module Description: Students investigate technologies used to convert petroleum and mineral resources into industrial (stock) materials used in secondary manufacturing processes, and they explain related career opportunities.

Module Parameters: Access to a primary manufacturing industry.

Access to a science, construction or fabrication laboratory.

This module requires off-campus learning experiences and should be combined with relevant work study, work experience and/or modules from the Career Transitions strand; consultation with the work-site supervisor will ensure that relevant safety considerations are addressed.

See the *Off-Campus Education Guide for Administrators, Counsellors and Teachers* (Alberta Education) for further information regarding off-campus learning.

Supporting Module: CTR2210 Workplace Safety (Practices) [Career Transitions Strand]; recommended for off-campus learning

Students must have a general knowledge of potential hazards and accepted safety practices relevant to specific processing and/or manufacturing sites prior to engaging in off-campus learning experiences. See Planning for Instruction in Section C of this Guide for further information regarding student safety.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **describe industrial (stock) materials produced through primary manufacturing processes**	• completing a research project on industrial (stock) materials produced through primary manufacturing. Research to address: – major categories of raw materials used in primary manufacturing – basic types of industrial (stock) materials produced through primary manufacturing, including metallic, structural, polymeric, ceramic and composite – standard forms for each type of industrial (stock) material. *Assessment Tool* *Research Process: Industrial (Stock) Materials, ENM3070–1* *Standard* *Complete all components of research to a standard of 3 on the rating scale*	10
• **describe relationships between the molecular structure, properties and applications of an industrial (stock) material**	• conducting laboratory and/or field-based investigations that involve: – identifying the mechanical, chemical, thermal, electrical/magnetic and optical properties of an industrial (stock) material – constructing models/diagrams that illustrate the molecular structure of an industrial (stock) material – relating the physical/chemical properties and molecular structure of an industrial (stock) material to its applications in secondary manufacturing. *Assessment Tool* *Lab Investigations: Advanced Level, ENMLAB–3* *Observation Checklist for Field-based Investigations, ENMOBS* *Standard* *Conduct lab investigations to a standard of 3 on the rating scale and/or complete all sections of the observation checklist for field-based investigations*	40

MODULE ENM3070: INDUSTRIAL MATERIALS (PRIMARY MANUFACTURING) (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• explain technologies used to manufacture a metallic, polymeric, ceramic or composite material	• a flow chart that outlines raw materials, processes and technologies involved in the manufacture of a metallic, polymeric, ceramic or composite material. *Assessment Tool* *Assessment Criteria: Flow Charts, ENMFLO* *Standard* *Complete the flow chart to a standard of 3 on the rating scale* • a summary of environmental assessment and management practices conducted by industry throughout manufacturing operations. *Assessment Tool* *Presentations/Reports: Advanced Level, ENMPRE–3* *Standard* *Achieve a minimum rating of 3 on the rating scale for Presentations/Reports*	30
• explain career opportunities relevant to a primary manufacturing industry	• conducting research on technical, professional and labour-based careers within the primary manufacturing industry. *Assessment Tool* *Career Search: Advanced Level, ENMCAR–3* *Standard* *Conduct research to a standard of 3 on the rating scale*	20
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

MODULE ENM3070: INDUSTRIAL MATERIALS (PRIMARY MANUFACTURING) (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Industrial (Stock) Materials	• compare primary and secondary manufacturing processes	Obtain a copy of *Edmonton Beneath Our Feet* from the Alberta Geological Survey.
	• describe major categories of nonrenewable resources (raw materials) used in primary manufacturing	Research applications of: • petroleum • natural gas • metallic ores • nonmetallic ores.
	• identify and describe major types of industrial (stock) materials produced through primary manufacturing processes:	
	– metallic	For example, ferrous, non-ferrous.
	– structural	For example, sand, gravel, crushed stone.
	– polymeric	For example, thermoplastic, thermoset.
	– ceramic	For example, clay-based, refractory, glass, abrasive.
	– composite	For example, layered, fibre-reinforced, particle.
	• describe standard forms for each type of industrial (stock) material: – plate, bar and rod – sheet, roll and film – pellet and powder	Provide examples and assemble a display of each type of industrial (stock) material.
	• describe major consuming industries for stock materials produced in Canada.	Research applications of stock materials in: • secondary manufacturing • construction • consumer/domestic use.
Properties and Applications	• describe and compare the molecular structure of a metallic, polymeric, ceramic and composite material	For example: • atoms and molecules • molecular arrangement • attractions and connections.

MODULE ENM3070: INDUSTRIAL MATERIALS (PRIMARY MANUFACTURING) (continued)

Concept	Specific Learner Expectations	Notes
Properties and Applications (continued)	*The student should:*	
	• construct models that illustrate the molecular structure of metallic, polymeric, ceramic and/or composite materials	
	• conduct experiments to determine the properties of an industrial (stock) material: – mechanical	For example, strength, elasticity and plasticity, malleability and ductility, hardness.
	– chemical – thermal	For example, conductivity, melting/freezing point, combustibility, rate of expansion.
	– electrical and magnetic	For example, conductivity, resistivity, permeability.
	– optical	For example, opacity, reflectivity, colour.
	• relate the properties of an industrial (stock) material to its molecular structure	Research the development of new materials for specific environments and applications.
	• explain how the properties of an industrial (stock) material determine its applications in product design and secondary manufacturing processes.	
Primary Manufacturing Technologies	• research the conversion of a nonrenewable resource into an industrial (stock) material within one of Canada's primary manufacturing industries • identify specific mineral ores and/or petroleum feedstocks used in the manufacturing process	Distinguish between the refining of rocks and minerals (ENM2070) and the manufacture of stock materials used in secondary manufacturing (ENM3070).
	• describe techniques employed to manufacture the stock material	For example: • thermal • chemical • mechanical • electrical.
	• construct a flow chart outlining major stages in the manufacturing process	Illustrate inputs, processes, outputs and feedback systems.

Concept	Specific Learner Expectations	Notes
	The student should:	
Primary Manufacturing Technologies (continued)	• explain applications of electronic equipment and computer technology in monitoring and controlling manufacturing operations	Draw/construct a simplified model of a primary manufacturing facility.
	• describe storage facilities and distribution systems within the industry, and their impact on industry location and product costs	Construct flow charts that depict facilities/steps in storage and distribution.
	• explain environmental assessment and management practices conducted by industry throughout manufacturing operations	Research environmental standards and the enforcement of safe operating procedures throughout manufacturing operations.
	• describe industry initiatives that respond to environmental concerns	For example: • waste treatment • emission control.
	• describe industry initiatives that address occupational health and safety requirements	For example: • odour scrubbers • noise suppressants • water purification.
	• describe industry initiatives in reprocessing and recycling to ensure a life-cycle approach to chemicals management.	Note links with ENM1090 (Fundamentals of Recycling).

MODULE ENM3070: INDUSTRIAL MATERIALS (PRIMARY MANUFACTURING) (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Career Opportunities	• research careers and the range of occupational opportunities within primary manufacturing industries; e.g.: – engineering – technical and support services – apprenticeship trades – environmental management	Plan for individual/group research and presentations that address: • job description • employment market • education/training • wage expectations.
	• explain the personnel structure within a primary manufacturing industry • evaluate current employment opportunities based on employment statistics	Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development).
	• research trends in the manufacture of industrial (stock) materials, and future career opportunities; e.g.: – developing new materials – recycling and resource conservation – waste management.	See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions. Arrange/facilitate: • information interviews • work study/experience • job shadowing.

MODULE ENM3080: MARKET BASICS & TRENDS

Level: Advanced

Theme: Technology and Applications

Prerequisite: None

Module Description: Students explain the basic principles involved in marketing an energy or mineral resource, and analyze trends in the development and marketing of energy or mineral products.

Module Parameter: Access to energy or mineral industry.

Supporting Module: ENM2080 Supply & Distribution

The student will:	*Assessment of student achievement should be based on:*	
• identify basic marketing principles and their application in an energy or mineral industry	• identify basic components of a marketing strategy used to transport and market an energy or mineral resource. Marketing components to address: – commodity supply – marketing structures – transportation – pricing – advertising and promotion – sales and distribution. *Assessment Tool* *Assessment Criteria: Components of a Marketing Strategy, ENM3080–1* *Standard* *Identify basic components of the marketing strategy to a standard of 3 on the rating scale*	20

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MODULE ENM3080: MARKET BASICS & TRENDS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **describe market demands for an energy or mineral product, and describe the impact of government policies on marketing practices**	• a presentation or report that describes current demands and markets for an energy or mineral commodity, product or service, and the impact of government policies on marketing practices. Report to include: – an analysis of social, political, economic and environmental factors affecting market demands – the identification of local, national and/or international markets – reflection on the importance of the energy or mineral resource to the Province of Alberta and the Government of Canada – the identification of three or more relevant government policies (e.g., local, provincial and/or national) – based on information gathered from government and industry contacts, a case history of the impacts of one policy on marketing practices. *Assessment Tool* *Presentations/Reports: Advanced Level, ENMPRE–3* *Standard* *Achieve a minimum rating of 3 on the rating scale for Presentations/Reports*	30
• **identify market trends and development opportunities in domestic and international markets**	• developing and presenting a plan for altering an energy or mineral-related policy, product or service, or developing a new policy, product or service. Plan to address: – consumer preferences and market opportunities – relevant social/economic/environmental factors – identification of a target market – a strategy for developing the product or service – local and global marketing strategies – supporting trade structures, policies and/or agreements. *Assessment Tool* *Assessment Criteria: Developing a Marketing Plan, ENM3080–2* *Standard* *Develop the plan to a standard of 3 on the rating scale*	40

MODULE ENM3080: MARKET BASICS & TRENDS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• explain career opportunities relevant to the development and marketing of energy or mineral products	• conducting research on technical, professional and labour-based careers within the marketing sector of an energy or mineral industry. *Assessment Tool* *Career Search: Advanced Level, ENMCAR–3* *Standard* *Conduct research to a standard of 3 on the rating scale*	10
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Market Principles	• research local, national and international markets for an energy or mineral resource	Identify factors affecting market demand.
	• analyze market demands and fluctuations	Research the role of consumer preferences in determining markets.
	• distinguish between nonregulated (open) and regulated (closed) marketing systems	Visit a local utility company and note products, services, etc.
	• identify and compare viable marketing alternatives for the product or service; e.g.: – direct producer marketing – open markets – marketing boards – cooperatives	Compare methods of advertising and promotion.

Concept	Specific Learner Expectations	Notes
	The student should:	
Market Principles (continued)	• identify factors that influence pricing of the product or service; e.g.: – market analysis – supply and demand – cost factors	Loan "The Gasoline Game" (a computer simulation that examines factors determining the price of gasoline) from the Petroleum Communication Foundation.
	• explain how products are moved to market, including the function of intermediate stops such as terminals and bulk plants	Explain the function of different types of pipelines: • gathering lines • crude oil trunk lines • product trunk lines.
	• describe the effectiveness of different methods of transportation; e.g.: – marine, road and rail systems – pipeline systems	
	• evaluate the role of advertising and promotion in retailing practices, and their impact on consumer demands.	Examine trends in promotional and marketing strategies. Design/evaluate an approach to marketing.
Market Practices	• identify social, political, economic and environmental factors that affect market demand for an energy or mineral resource	Explain how market demand may be influenced by: • consumer trends • trade liberalization • inflation and dollar value • environmental concerns.
	• research and prepare a case history on market demands for one energy or mineral commodity	Obtain the *Canadian Minerals Yearbook* from Natural Resources Canada.
	• identify major export partners for oil, oil products and natural gas, coal and coal-generated energy, or mineral resources	Gather information and statistics from a variety of current sources; e.g.: • by talking to specialists • by contacting government agencies • by searching the Internet. Locate major export partners on a map of the world.

MODULE ENM3080: MARKET BASICS & TRENDS (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Market Practices (continued)	• compare the nature and extent of Canada's market share in North America, the Pacific Rim, Europe and other locations	Consider the competitive advantages and disadvantages of different nations.
	• identify national and provincial government policies that influence the development and marketing of an energy or mineral resource	Research impacts of: • National Energy Program • Western Economic Diversification • Oil and Gas Royalty Reduction.
	• research and prepare a case history regarding the impact of one government policy on the development and marketing of an energy or mineral resource in Canada	Contact government and industry resource persons.
	• evaluate the impact of national and provincial environmental protection policies on the development and marketing of a commodity or product	For example: • cost of production • market demand for "green" products.
	• evaluate the impact of national and provincial transportation policies on the development and marketing of a commodity or product	For example: • product price • extent of market.
	• evaluate the impact of provincial, national and international trade agreements on the development and marketing of an energy or mineral resource.	For example: • Western/Atlantic Accord • North American Free Trade Agreement • European Economic Community.
Market Development	• consider factors that influence market trends and resulting trade opportunities	For example: • demographic • environmental • economic.
	• evaluate the impact of developing technologies on one of Canada's energy or mineral products	For example: • production efficiency • resource utilization • development of value-added commodities.
	• identify market opportunities that arise from product diversification and specialization, international trade and participation in a global economy	Research new and emerging products and/or services derived from an energy or mineral resource.

MODULE ENM3080: MARKET BASICS & TRENDS (continued)

Concept	Specific Learner Expectations	Notes
Market Development (continued)	*The student should:* • outline market conditions leading to, and steps in altering, a product or service, or developing a related product or service • explain the role of market research and product development in adapting a commodity, product or service to meet present and anticipated needs • evaluate opportunities for the global marketing of a commodity, product or service • compare approaches used to market a commodity, product or service in Canada with approaches used in other nations.	Research steps taken to patent a product or process. Design and conduct a survey regarding consumer preferences for a product or service. Consider market opportunities in: • the United States and Mexico • nations of the Pacific Rim • other developing nations.

Career Opportunities	• research careers and the range of occupational opportunities related to marketing an energy or mineral resource; e.g.:
	– market survey
	– advertising and sales
	– transportation and distribution
	– product development
	– support services
	  • legal
	  • consulting
	  • environmental
	• infer career opportunities and trends from employment statistics
	• research trends in the marketing sector of an energy or mineral industry, and resulting career opportunities.
		Plan for individual/group research and presentations that address:
		• job description
		• employment market
		• education/training
		• wage expectations.
		Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development).
		See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.
		Arrange/facilitate:
		• information interviews
		• work study/experience
		• job shadowing.

MODULE ENM3090: ENERGY DESIGNS/SYSTEMS 2 (PRACTICAL APPLICATIONS)

Level: Advanced

Theme: Management and Conservation

Prerequisite: ENM2090 Energy Designs/Systems 1 (Basic Principles)

Module Description: Students analyze energy-saving technologies and systems and design a residential/commercial structure or transportation technology that demonstrates the principles of energy conservation and efficiency.

Module Parameters: Access to a construction, fabrication, mechanics or science laboratory.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • describe energy use within a residential/ commercial environment or transportation sector	*Assessment of student achievement should be based on:* • conducting an energy audit within a residential/ commercial environment or transportation sector. Audit to include: – an inventory/review of past and present energy use – the establishment of acceptable goals for energy efficiency and consumption – proposed strategies for achieving energy-use goals. *Assessment Tool* *Task Checklist: Energy Audit, ENM3090–1* *Standard* *Complete the energy audit to a standard of 3 on the rating scale*	40

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Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• design a residential/ commercial structure or transportation technology that uses energy conservation and efficiency	• given a problem in energy design, constructing a drawing/model of a residential/commercial structure or transportation technology that addresses the problem. The drawing/model must illustrate: – a clear response to the design problem – component parts and processes – efficient use of energy and other resources – regard for human and environmental safety. *Assessment Tool* *Project Assessment: Technology Design, ENMTEC* *Assessment Criteria: Diagrams and Technical Drawings, ENMDRA* *Standard* *Complete the design and drawing/model to a standard of 3 on the rating scale*	50
• explain career opportunities relevant to energy design and technology	• completing a research project on one or more career opportunities in energy design. *Assessment Tool* *Career Search: Advanced Level, ENMCAR–3* *Standard* *Conduct research to a standard of 3 on the rating scale*	10
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Energy Analysis	• conduct an inventory of energy use within a residential/commercial environment or transportation sector	Ask local utility companies about energy analysis in residential/ commercial environments.

MODULE ENM3090: ENERGY DESIGNS/SYSTEMS 2 (PRACTICAL APPLICATIONS)
(continued)

Concept	Specific Learner Expectations	Notes
Energy Analysis (continued)	*The student should:* • analyze energy efficiency within the residential/ commercial environment or transportation sector • establish a target level of energy efficiency and determine potential savings that may result from achieving this target • research technologies and/or strategies that can be used to achieve the target level of energy efficiency.	If analyzing energy use in the transportation sector, refer to *Wise Use of Petroleum Resources: The Car in Our Daily Lives* (see Section I: Learning Resource Guide). Plan for: • discussion and debate • personal action plans. Contact resource persons from the residential, commercial or transportation sector.
Low Energy Designs and Systems	• identify an energy design problem relevant to a residential/commercial structure or transportation technology • research design technologies available to respond to the situation • identify limitations present in the design problem • examine similar structures or technologies that incorporate energy efficient design suitable for the context • generate alternatives regarding the design, select the most appropriate alternative, and plan a sequence of tasks to create the structure or technology • make/model a structure or technology by following plans that have been established	Consider design problems and solutions that address: • size and/or weight • topographic and/or climatic factors • energy transfer and/or conversion • comfort and practical use • cost limitations. Approach problems from a historical perspective (e.g., 1980s energy crisis and the development of the fuel injector). Talk to others to clarify ideas. Consider similar problems and how they were solved. Make reasoned judgements regarding design potential. Plan for: • drawing/designing • constructing models.

MODULE ENM3090: ENERGY DESIGNS/SYSTEMS 2 (PRACTICAL APPLICATIONS) (continued)

Concept	Specific Learner Expectations	Notes
Low Energy Designs and Systems (continued)	*The student should:* • evaluate the strengths and limitations of the energy design, and consider alternatives that may improve the process and/or outcomes.	Assess the design in relation to: • original needs and intentions • efficient use of resources • human and environmental safety.
Career Opportunities	• research careers and the range of occupational opportunities in low energy design and technology; e.g.: – engineering – technical and support services – environmental management	Plan for individual/group research and presentations that address: • job description • employment market • education/training • wage expectations. Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development).
	• infer career opportunities and trends from employment statistics	See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.
	• research trends in low energy designs and systems, and resulting career opportunities.	Arrange/facilitate: • information interviews • work study/experience • job shadowing.

MODULE ENM3100: INTEGRATED RESOURCE MANAGEMENT (BALANCING NEEDS)

Level: Advanced

Theme: Management and Conservation

Prerequisite: None

Module Description: Students develop and present an integrated plan for sustainable resource development that incorporates supply side and demand side resource management.

Module Parameters: Access to government, industry and community organizations responsible for sustainable energy management and environmental stewardship.

Note: This is a summative module that requires prior knowledge of the principles of sustainable development. It should be the last module studied in a series of Energy and Mines modules.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • describe basic principles of resource management	*Assessment of student achievement should be based on:* • a presentation or report that provides definitions and Alberta examples of: – renewable and nonrenewable resources – conservation – sustainable development – supply-side management – demand-side management – integrated resource use. *Assessment Tool* *Presentations/Reports: Advanced level, ENMPRE–3* *Standard* *Achieve a minimum rating of 3 on the rating scale for Presentations/Reports*	20

MODULE ENM3100: INTEGRATED RESOURCE MANAGEMENT (BALANCING NEEDS) (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• present a plan for the sustainable development and integrated use of an energy or mineral resource	• developing and presenting a plan for the sustainable development and integrated use of an energy or mineral resource. Plan to address: – short- and long-term goals and objectives – the views of relevant stakeholder groups – a process for public involvement – proposed management standards and guidelines – a schedule of development activities – a map/flow chart that identifies existing and proposed developments, processes and technologies, and supply/distribution networks – permits, licences and/or other legal agreements that may affect the plan – a strategy for monitoring use and resolving potential conflicts. *Assessment Tool* *Assessment Criteria: Developing a Resource Management Plan, ENM3100–1* *Standard* *Achieve a minimum performance rating of:* *– 2 in management outcomes* *– 3 in planning processes*	70
• explain career opportunities relevant to resource management	• completing a research project on one or more career clusters in resource management. *Assessment Tool* *Career Search: Advanced Level, ENMCAR–3* *Standard* *Conduct research to a standard of 3 on the rating scale*	10
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

MODULE ENM3100: INTEGRATED RESOURCE MANAGEMENT (BALANCING NEEDS) (continued)

Concept	Specific Learner Expectations	Notes
Management Principles	*The student should:* • explain sustainable development, conservation and environmental citizenship within the context of Alberta's energy or mineral resources • describe principles of supply-side resource management and demand-side resource management by citing examples of each within Alberta • research local opportunities for consultation and public involvement in resource management decisions.	**This is a summative module requiring background knowledge of development principles. It should be the last module studied in a sequence of Energy and Mines modules.** For example: • community associations • industry • local government • provincial departments/ agencies.
Planning Process	• describe short- and long-term goals for the sustainable development and integrated use of an energy or mineral resource • identify major factors to be addressed in a resource management plan: – the objectives of different stakeholders – relevant government legislation/regulations – an inventory of existing resources – appropriate development and production techniques – market characteristics and trends – applications of research and technology • identify alternatives regarding supply-side and demand-side management, and select the preferred alternatives	For example: • social • economic • environmental. Invite resource managers from local energy/ mineral industry to explain management processes and techniques. Survey the views of different stakeholder groups and resolve conflicts that may arise. For example: • recreational • environmental • industrial • agricultural. Incorporate consultation with other resource users and public involvement into the planning process. Interview local landowners regarding their views on resource management.

MODULE ENM3100: INTEGRATED RESOURCE MANAGEMENT (BALANCING NEEDS) (continued)

Concept	Specific Learner Expectations	Notes
Planning Process (continued)	*The student should:* • describe on permits, licences or other legal agreements that may be required	
	• identify a set of actions and present the management plan; e.g.: – a general description of the resource and proposed developments – long- and short-term management objectives – proposed management standards and guidelines – a schedule of short-term development activities	Specific management plans will vary, but need to address some common actions.
	• prepare a map/flow chart to accompany and elaborate upon the management plan • describe techniques for monitoring resource use, management outcomes and resolving potential conflicts.	Maps/flow charts might illustrate: • location of resources • proposed development activities • supply and distribution networks • interactions with other sectors.
Career Opportunities	• research careers and the range of occupational opportunities in resource management; e.g.: – engineering – technical and support services – environmental management	Plan for individual/group research and presentations that address: • job description • employment market • education/training • wage expectations. Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development).
	• evaluate current employment opportunities based on employment statistics	See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.
	• research trends in resource management, and future career opportunities.	Arrange/facilitate: • information interviews • work study/experience • job shadowing.

ENERGY AND MINES

SECTION G: ASSESSMENT TOOLS

The following pages comprise background information and strategies for assessing student achievement and the assessment tools that are listed in Sections D, E and F of this Guide.

This section of the Guide to Standards and Implementation has been designed to provide a common base of understanding about the level of competencies students are expected to demonstrate to successfully complete a module. The goal is to establish assessment standards for junior and senior high school students that are fair, credible and challenging.

These tools will assist teachers throughout the province to more consistently assess student achievement. The purpose of expanding on the assessment standards is to:

- increase confidence among students, parents, business/industry and post-secondary that students can demonstrate the competencies specified in the modules they have completed
- encourage fairness and equity in how students' efforts are judged
- enable learners to focus effort on key learnings
- support teachers and community partners in planning and implementing CTS.

These tools were validated during the optional stage of CTS implementation.

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ASSESSING STUDENT ACHIEVEMENT IN CTS

The CTS assessment standards assess two basic forms of competency:

- What can a student *do*?
  - **make** a product (e.g., wood bowl, report, garment)
  - **demonstrate** a process
    - strand-related competencies (e.g., keyboarding, hair cutting, sewing techniques, lab procedures)
    - basic competencies (e.g., resource use, safety procedures, teamwork).
- What does a student *know*?
  - knowledge base needed to demonstrate a competency (link theory and practice).

CTS Defines *Summative* Assessment Standards

The assessment standards and tools defined for the CTS modules, referenced in Sections D, E and F of this Guide, focus on the final (or summative) assessment of student achievement.

Assessment throughout the learning period (formative assessment) will continue to evaluate how students are progressing. Teachers direct and respond to students' efforts to learn—setting and marking tasks and assignments, indicating where improvement is needed, sending out interim reports, congratulating excellence, etc.

Teachers will decide which instructional and assessment strategies to apply during the formative learning period. As formative and summative assessment are closely linked, some teachers may wish to modify the tools included in this section to use during the instructional process. Teachers may also develop their own summative assessment tools as long as the standards are consistent with the minimum expectations outlined by Alberta Education.

Grading and Reporting Student Achievement

When a student can demonstrate ALL of the exit-level competencies defined for the module (module learner expectations), the teacher will designate the module as "successfully completed." The teacher will then use accepted grading practices to determine the percentage grade to be given for the module—a mark not less than 50%.

The time frame a teacher allows a student to develop the exit-level competency is a local decision. NOTE: The Senior High School Handbook specifies that students must have access to 25 hours of instruction for each credit. Students may, however, attain the required competencies in less time and may proceed to other modules.

Teachers are encouraged to consult their colleagues to ensure grading practices are as consistent as possible.

High school teachers may wish to refer to "Directions for Reporting Student Achievement in CTS" for information on how to use the CTS course codes to report the credits that students have earned to Alberta Education. (Copies of this document have been forwarded to superintendents and senior high school principals.)

Components of Assessment Standards in CTS

The following components are included in each module:

- **module learner expectations** (in the shaded left column of the module) define the exit-level competencies students are expected to achieve to complete a module. Each MLE defines and describes critical behaviours that can be measured and observed. The student must meet the standard specified for ALL MLEs within a module to be successful.

- **suggested emphasis** (right column of the module) provides a guideline for the relative significance of each MLE and can be used to organize for instruction.

- **criteria and conditions** (middle column of the module) set the framework for the assessment of student competency, specifying the minimum standard for performance and including a reference to assessment tools, where appropriate.

  Criteria define the behaviours that a student must demonstrate to meet the designated standard. For example, the criteria could describe the various techniques that must be demonstrated when using a tool, and/or describe the minimum components of a project the student must complete.

  Conditions outline the specifications under which a student's competency can be judged. For example, the conditions could specify whether the assessment should be timed or not, or if the student should be allowed to access support resources or references.

  Standard may be defined by (1) assessment tools and/or (2) "illustrative examples" of student work (both of which are referenced in this section, or sometimes in approved learning resources).

  Assessment Tools included in this section of the Guide tend to be of two types:

  - tools generic to a strand or to the entire CTS program; e.g., a standard five-point rating scale is used in all strands. Other generic tools include assessing reports and presentations and lab safety checklists. *(Names of these tools include the strand code [e.g., "INF" for Information Processing] and a code for the type of tool [e.g., "TDENT" for Text-Data Entry].)*
  - tools specific to a module; e.g., assessment checklist for assessing a venture plan in Enterprise and Innovation or a checklist for sketching, drawing and modelling in Design Studies. *(Names of these tools include the module code; e.g., "INF1010–1" indicating that it is the first module-specific tool used in Information Processing Module 1010.)*

Development and Validation Processes

The "Criteria and Conditions" and "Suggested Emphasis" columns have been validated with extensive input from teachers, professional associations/contacts and post-secondary institutions. The goal was to prepare well-structured assessment standards and related assessment tools that:

- establish an appropriate level of challenge and rigour
- relate directly to the type of learning described in the curriculum standard
- are easy to understand
- are efficient to implement
- can provide a consistent measure of what was expected to be measured.

As students and teachers work with the assessment standards and tools, it is expected that levels of performance will increase as more and more students are able to achieve the minimum standard. Therefore, the assessment standards and related tools will continue to be monitored, and revised as necessary to ensure appropriate levels of rigour and challenge, and successful transitions for students as they leave high school and enter the workplace or related post secondary programs.

ASSESSING STUDENT ACHIEVEMENT IN ENERGY AND MINES

Assessing student achievement in Energy and Mines involves gathering information about what a student knows and is able to do, and comparing this information with learning outcomes defined by the curriculum (i.e., module learner expectations, assessment conditions and criteria, illustrative examples/reference sets).

Summative assessment for each module in Energy and Mines will focus attention on process (e.g., how the student approaches/performs particular tasks) and product (e.g., quality characteristics of the task performed, item produced or service rendered). While there are also knowledge-based components of learning within each module, a greater emphasis has been suggested for learning that involves the transfer/application of knowledge in task- or service-oriented situations.

Assessment Strategies and Tools

A variety of assessment tools are provided for assessing student performance within each module. Each tool communicates, through a five-point rating scale, a minimum standard for the completion of a learning task. Criteria for assessing the "basic competencies" students are expected to demonstrate throughout the learning process have been integrated with other performance criteria in each tool.

The assessment tools, when used collectively for a particular module, will assist teachers to assess successful module completion in an equitable and consistent manner. Depending on the way the classroom is organized, assessment tools may be used with individual students upon completion of specific learning tasks, or with the entire class at the end of a learning period.

Tools Generic to CTS

The generic rating scale has been used to develop several of the tools in CTS. A generic framework for assessing the processes CTS students apply in completing a task or project is included in this section. It is based on the notion that students will follow a process as they work through their projects and that this process has a number of sequential steps. The framework shows the increasing expectations from the introductory, to the intermediate, to the advanced level.

Some assessment tools, e.g., Presentations/Reports (CTSPRE) are generic to CTS and have been included in this section. In assessing MLEs at the introductory level, PRE100 would be used. Since the content portion of this tool must relate specifically to an MLE in a module, the tool has been adapted, labelled and included under Assessment Tools Specific to the Energy and Mines strand, ENM, and to the module, e.g., ENM1010 (module number), and the tool number (within the module), e.g., ENM1010–1.

The Basic Competencies Reference Guide can be used directly as a checklist or as a guide to assess these competencies through other teacher-developed tools.

Tools Generic to Energy and Mines

Assessment tools generic to Energy and Mines have been developed to assist in assessing student performance in key areas of learning across the scope and sequence. The generic tools communicate minimum performance standards for:

- conducting research, preparing reports and making presentations
- performing practical tasks in technology design and construction
- conducting laboratory and field-based investigations
- analyzing, negotiating and debating energy- and environment-related issues
- proposing personal/shared actions that foster environmental citizenship
- exploring career trends and conducting searches of employment opportunities.

The generic tools, referenced as applicable throughout each module in the conditions and criteria column, are identified with a six- or nine-letter code (e.g., ENMOBS, ENMLOG–VOL). Generic tools developed for use in modules at a specific level are further identified by a number (e.g., ENMPRE–1 for introductory, ENMPRE–2 for intermediate, ENMPRE–3 for advanced).

Tools Specific to Energy and Mines Modules

Other assessment tools have been developed to assess competencies that are unique to specific modules within the Energy and Mines strand. These "module-specific" tools, also referenced in the conditions and criteria column for each module, are identified by the module number followed by a tool number (e.g., ENM1070–1 for the first module-specific tool in module ENM1070).

In some instances, authorized learning resources have been identified as assessment tools for specific modules. These learning resources usually contain test banks and other assessment strategies considered effective in establishing minimum standards for achievement.

Where appropriate, "Illustrative Examples" or "Sample Assignments/Projects" have been provided in a further attempt to communicate realistic expectations and acceptable standards of achievement.

BASIC COMPETENCIES REFERENCE GUIDE

The chart below outlines basic competencies that students endeavour to develop and enhance in each of the CTS strands and modules. Students' basic competencies should be assessed through observations involving the student, teacher(s), peers and others as they complete the requirements for each module. In general, there is a progression of task complexity and student initiative as outlined in the Developmental Framework*. **As students progress through Stages 1, 2, 3 and 4 of this reference guide, they build on the competencies gained in earlier stages**. Students leaving high school should set themselves a goal of being able to demonstrate Stage 3 performance.

Suggested strategies for classroom use include:

- having students rate themselves and each other
- using in reflective conversation between teacher and student
- highlighting areas of strength
- tracking growth in various CTS strands
- highlighting areas upon which to focus
- maintaining a student portfolio.

Stage 1— *The student:*	**Stage 2**— *The student:*	**Stage 3**— *The student:*	**Stage 4**— *The student:*
Managing Learning			
☐ comes to class prepared for learning	☐ ——→——→	☐ ——→——→	☐ ——→——→
☐ follows basic instructions, as directed	☐ follows instructions, with limited direction	☐ follows detailed instructions on an independent basis	☐ ——→——→
	☐ sets goals and establishes steps to achieve them, with direction	☐ sets clear goals and establishes steps to achieve them	☐ demonstrates self-direction in learning, goal setting and goal achievement
☐ acquires specialized knowledge, skills and attitudes	☐ applies specialized knowledge, skills and attitudes in practical situations	☐ transfers and applies specialized knowledge, skills and attitudes in a variety of situations	☐ transfers and applies learning in new situations; demonstrates commitment to lifelong learning
☐ identifies criteria for evaluating choices and making decisions	☐ identifies and applies a range of effective strategies for solving problems and making decisions	☐ uses a range of critical thinking skills to evaluate situations, solve problems and make decisions	☐ thinks critically and acts logically to evaluate situations, solve problems and make decisions
☐ uses a variety of learning strategies	☐ explores and uses a variety of learning strategies, with limited direction	☐ selects and uses effective learning strategies	☐ ——→——→
		☐ cooperates with others in the effective use of learning strategies	☐ provides leadership in the effective use of learning strategies
Managing Resources			
☐ adheres to established timelines; uses time/schedules/planners effectively	☐ creates and adheres to timelines, with limited direction; uses time/schedules/planners effectively	☐ creates and adheres to detailed timelines on an independent basis; prioritizes task; uses time/schedules/planners effectively	☐ creates and adheres to detailed timelines; uses time/schedules/planners effectively; prioritizes tasks on a consistent basis
☐ uses information (material and human resources), as directed	☐ accesses and uses a range of relevant information (material and human resources), with limited direction	☐ accesses a range of information (material and human resources), and recognizes when additional resources are required	☐ uses a wide range of information (material and human resources) in order to support and enhance the basic requirement
☐ uses technology (facilities, equipment, supplies), as directed, to perform a task or provide a service	☐ uses technology (facilities, equipment, supplies), as appropriate, to perform a task or provide a service, with minimal assistance and supervision	☐ selects and uses appropriate technology (facilities, equipment, supplies) to perform a task or provide a service on an independent basis	☐ recognizes the monetary and intrinsic value of managing technology (facilities, equipment, supplies)
☐ maintains, stores and/or disposes of equipment and materials, as directed	☐ maintains, stores and/or disposes of equipment and materials, with limited assistance	☐ maintains, stores and/or disposes of equipment and materials on an independent basis	☐ demonstrates effective techniques for managing facilities, equipment and supplies
Problem Solving and Innovation			
☐ participates in problem solving as a process ☐ learns a range of problem-solving skills and approaches	☐ identifies the problem and selects an appropriate problem-solving approach, responding appropriately to specified goals and constraints	☐ thinks critically and acts logically in the context of problem solving	☐ identifies and resolves problems efficiently and effectively
☐ practices problem-solving skills by responding appropriately to a clearly defined problem, specified goals and constraints, by: – generating alternatives – evaluating alternatives – selecting appropriate alternative(s) – taking action	☐ applies problem-solving skills to a directed or a self-directed activity, by: – generating alternatives – evaluating alternatives – selecting appropriate alternative(s) – taking action	☐ transfers problem-solving skills to real-life situations, by generating new possibilities ☐ prepares implementation plans ☐ recognizes risks	☐ identifies and suggests new ideas to get the job done creatively, by: – combining ideas or information in new ways – making connections among seemingly unrelated ideas – seeking out opportunities in an active manner

Stage 1— *The student:*	**Stage 2—** *The student:*	**Stage 3—** *The student:*	**Stage 4—** *The student:*
Communicating Effectively			
☐ uses communication skills; e.g., reading, writing, illustrating, speaking	☐ communicates thoughts, feelings and ideas to justify or challenge a position, using written, oral and/or visual means	☐ prepares and effectively presents accurate, concise, written, visual and/or oral reports providing reasoned arguments	☐ negotiates effectively, by working toward an agreement that may involve exchanging specific resources or resolving divergent interests
☐ uses language in appropriate context	☐ uses technical language appropriately	☐ encourages, persuades, convinces or otherwise motivates individuals	☐ negotiates and works toward a consensus
☐ listens to understand and learn	☐ listens and responds to understand and learn	☐ listens and responds to understand, learn and teach	☐ listens and responds to understand, learn, teach and evaluate
☐ demonstrates positive interpersonal skills in selected contexts	☐ demonstrates positive interpersonal skills in many contexts	☐ demonstrates positive interpersonal skills in most contexts	☐ promotes positive interpersonal skills among others
Working with Others			
☐ fulfills responsibility in a group project	☐ →	☐ seeks a team approach, as appropriate, based on group needs and benefits; e.g., idea potential, variety of strengths, sharing of workload	☐ leads, where appropriate, mobilizing the group for high performance
☐ works collaboratively in structured situations with peer members	☐ cooperates to achieve group results	☐ works in a team or group: – encourages and supports team members – helps others in a positive manner – provides leadership/followership as required – negotiates and works toward consensus as required	☐ understands and works within the context of the group
☐ acknowledges the opinions and contributions of others in the group	☐ maintains a balance between speaking, listening and responding in group discussions		☐ prepares, validates and implements plans that reveal new possibilities
	☐ respects the feelings and views of others		
Demonstrating Responsibility			
Attendance			
☐ demonstrates responsibility in attendance, punctuality and task completion	☐ →	☐ →	☐ →
Safety			
☐ follows personal and environmental health and safety procedures	☐ recognizes and follows personal and environmental health and safety procedures	☐ establishes and follows personal and environmental health and safety procedures	☐ transfers and applies personal and environmental health and safety procedures to a variety of environments and situations
☐ identifies immediate hazards and their impact on self, others and the environment	☐ identifies immediate and potential hazards and their impact on self, others and the environment	☐ →	☐ →
☐ follows appropriate/emergency response procedures	☐ →	☐ →	☐ →
			☐ demonstrates accountability for actions taken to address immediate and potential hazards
Ethics			
☐ makes personal judgements about whether or not certain behaviours/actions are right or wrong	☐ assesses how personal judgements affect other peer members and/or family; e.g., home and school	☐ assesses the implications of personal/group actions within the broader community; e.g., workplace	☐ analyzes the implications of personal/group actions within the global context
			☐ states and defends a personal code of ethics as required

★ **Developmental Framework**			
• *Simple task* • *Structured environment* • *Directed learning*	• *Task with limited variables* • *Less structured environment* • *Limited direction*	• *Task with multiple variables* • *Flexible environment* • *Self-directed learning, seeking assistance as required*	• *Complex task* • *Open environment* • *Self-directed/self-motivated*

GENERIC RATING SCALE

SCALE	**RUBRIC STATEMENT** **(included in assessment tool/statements in *italics* are optional)** ***The student:***	**IS TASK/ PROJECT COMPLETED?**	**PROBLEM SOLVING:** **STUDENT INITIATIVE VS TEACHER DIRECTION/ SUPPORT**	**USE OF TOOLS, MATERIALS, PROCESSES**	***STANDARDS OF QUALITY/ PRODUCTIVITY***	***TEAMWORK LEADERSHIP***	***SERVICE CLIENT/ CUSTOMER***
4	exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards. Leads others to contribute team goals. Analyzes and provides effective client/customer services beyond expectations.*	Exceeds defined outcomes.	Plans and solves problems effectively and creatively in a self-directed manner.	Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.	*Quality, particularly details and finishes, and productivity are consistent and exceed standards.*	*Leads others to contribute team goals.*	*Analyzes and provides effective client/customer services beyond expectations.*
3	meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent. Works cooperatively and contributes ideas and suggestions that enhance team effort. Analyzes and provides effective client/customer services.*	Meets defined outcomes.	Plans and solves problems in a self-directed manner.	Tools, materials and/or processes are selected and used efficiently and effectively.	*Quality and productivity are consistent.*	*Works cooperatively and contributes ideas and suggestions that enhance team effort.*	*Analyzes and provides effective client/customer services.*
2	meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively to achieve team goals. Identifies and provides customer/client services.*	Meets defined outcomes.	Plans and solves problems with limited assistance.	Tools, materials and/or processes are selected and used appropriately.	*Quality and productivity are reasonably consistent.*	*Works cooperatively to achieve team goals.*	*Identifies and provides customer/client services.*
1	meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively. Provides a limited range of customer/client services.*	Meets defined outcomes.	Follows a guided plan of action.	A limited range of tools, materials and/or processes are used appropriately.	*Quality and productivity are reasonably consistent.*	*Works cooperatively.*	*Provides a limited range of customer/client services.*
0	has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.	Has not completed defined outcomes.		Tools, materials and/or processes are used inappropriately.			

ASSESSMENT FRAMEWORK: ISSUE ANALYSIS

INTRODUCTORY	INTERMEDIATE	ADVANCED
The student:	*The student:*	*The student:*
Preparation and Planning	**Preparation and Planning**	**Preparation and Planning**
• accurately describes an issue on which people disagree	• accurately describes an issue on which people disagree, explaining areas of disagreement	• accurately describes an issue on which people disagree, explaining specific causes of disagreement
• poses an important question regarding the issue	• poses one or more thoughtful questions regarding the issue	• poses thoughtful questions regarding the issue
• accesses basic in-school/community information sources regarding the issue	• accesses a range of relevant in-school/community resources	• accesses a range of relevant information sources and recognizes when additional information is required
• uses one or more information-gathering techniques	• uses a range of information-gathering techniques	• demonstrates resourcefulness in collecting data
Analyzing Perspectives	**Analyzing Perspectives**	**Analyzing Perspectives**
• clarifies different points of view regarding the issue; *e.g., social, economic, environmental*	• categorizes different points of view regarding the issue; *e.g., cultural, ethical, economic, environmental, health-related*	• categorizes different points of view regarding the issue; *e.g., cultural, ethical, economic, environmental, health-related, scientific, political*
• states a position on the issue and logical reasons for adopting that position	• states a position on the issue and logical reasons for adopting that position	• states a position on the issue and insightful reasons for adopting that position
• states an opposing position on the issue and logical reasons for adopting that position	• states two or more opposing positions on the issue and logical reasons for adopting each position	• states three or more opposing positions on the issue and thoughtful reasons for adopting each position
• identifies sources of conflict among different positions	• describes interrelationships among different perspectives/points of view	• analyzes interrelationships among different perspectives/points of view
• distinguishes between fact and fiction/opinion/theory	• determines accuracy/currency/reliability of information and ideas	• recognizes underlying bias/assumptions/values in information and ideas
Collaboration and Teamwork	**Collaboration and Teamwork**	**Collaboration and Teamwork**
• shares work appropriately among group members	• shares work appropriately among group members	• shares work appropriately among group members
• respects the views of others	• respects and considers the views of others	• respects and considers the views of others
	• negotiates solutions to problems	• negotiates with sensitivity solutions to problems
Evaluating Choices/Making Decisions	**Evaluating Choices/Making Decisions**	**Evaluating Choices/Making Decisions**
• identifies useful alternatives regarding the issue	• identifies important and appropriate alternatives regarding the issue	• describes in detail important and appropriate alternatives regarding the issue
• establishes criteria for assessing each alternative; *e.g., social, economic, environmental*	• establishes knowledge- and value-based criteria for assessing each alternative; *e.g., social, economic, environmental*	• establishes knowledge- and value-based criteria for assessing each alternative; *e.g., social, economic, environmental*
• selects an appropriate alternative based on established criteria	• selects an appropriate alternative by showing differences among choices	• selects an appropriate and useful alternative by showing differences among choices
• reflects on strengths/weaknesses of decisions by considering consequences	• assesses strengths/weaknesses of decisions by considering consequences	• assesses strengths/weaknesses of decisions by considering consequences and implications
• communicates information in a logical sequence to justify choices/decisions made	• communicates ideas in a logical sequence with supporting detail to justify choices/decisions made	• communicates thoughts/feelings/ideas clearly to justify choices/decisions made

ASSESSMENT FRAMEWORK: LAB INVESTIGATIONS

CTSLAB

INTRODUCTORY	INTERMEDIATE	ADVANCED
The student:	*The student:*	*The student:*
Management • prepares self for task • organizes and works in an orderly manner • carries out instructions accurately • uses time effectively	**Management** • prepares self for task • organizes and works in an orderly manner • interprets and carries out instructions accurately • plans and uses time effectively • adheres to routine procedures	**Management** • prepares self for task • organizes and works in an orderly manner • interprets and carries out instructions accurately • plans and uses time effectively in a logical sequence • displays leadership in adhering to routine procedures • attempts to solve problems prior to requesting help
Teamwork • cooperates with group members • shares work appropriately among group members	**Teamwork** • cooperates with group members • shares work appropriately among group members • negotiates solutions to problems	**Teamwork** • cooperates with group members • shares work appropriately among group members • negotiates with sensitivity solutions to problems • displays effective communication skills
Equipment and Materials • selects and uses appropriate equipment/materials • follows safe procedures/techniques • weighs and measures accurately • returns clean equipment/materials to storage areas	**Equipment and Materials** • selects and uses appropriate equipment/materials • models safe procedures/techniques • weighs and measures accurately • practises proper sanitation procedures • minimizes waste of materials • advises of potential hazards and necessary repairs	**Equipment and Materials** • selects and uses equipment/materials independently • demonstrates concern for safe procedures/techniques • weighs and measures accurately and efficiently • practises proper sanitation procedures • minimizes waste of materials • anticipates potential hazards and emergency response
Investigative Techniques • gathers and applies information from at least one source • makes predictions that can be tested • sets up and conducts experiments to test a prediction • distinguishes between manipulated/responding variables • obtains results that can be used to determine if some aspect of the prediction is accurate • summarizes important experimental outcomes	**Investigative Techniques** • gathers and applies information from a variety of sources • makes predictions that can be tested • plans, sets up and conducts experiments to test a prediction • identifies and explains manipulated/responding variables • obtains accurate results that confirm/reject the prediction • summarizes and applies experimental outcomes	**Investigative Techniques** • uses relevant information to explain observations • makes predictions that can be tested • plans, sets up and conducts experiments to test a prediction • analyzes relationships among manipulated/responding variables • obtains accurate results that confirm/reject prediction and answer related questions • summarizes, applies and evaluates experimental outcomes

ASSESSMENT FRAMEWORK: NEGOTIATION AND DEBATE

CTSNEG

INTRODUCTORY	INTERMEDIATE	ADVANCED
The student:	*The student:*	*The student:*
Preparation and Planning	**Preparation and Planning**	**Preparation and Planning**
• accurately describes an issue on which people disagree	• accurately describes an issue on which people disagree, explaining areas of disagreement	• accurately describes an issue on which people disagree, explaining specific causes of disagreement
• poses an important question regarding the issue	• poses one or more thoughtful questions regarding the issue	• poses thoughtful questions regarding the issue
• accesses basic in-school/community information sources regarding the issue	• accesses a range of relevant in-school/community resources	• accesses a range of relevant information sources and recognizes when additional information is required
• uses one or more information-gathering techniques	• uses a range of information-gathering techniques	• demonstrates resourcefulness in collecting data
Analyzing Perspectives	**Analyzing Perspectives**	**Analyzing Perspectives**
• states a position on the issue and logical reasons for adopting that position	• states a position on the issue and logical reasons for adopting that position	• states a position on the issue and insightful reasons for adopting that position
• explains why the issue is important by presenting examples of possible consequences	• explains why the issue is important by presenting examples of possible consequences	• explains why the issue is important by presenting examples of possible consequences and implications
• clarifies different points of view regarding the issue; *e.g., social, economic, environmental*	• categorizes different points of view regarding the issue; *e.g., cultural, ethical, economic, environmental, health-related*	• categorizes different points of view regarding the issue; *e.g., cultural, ethical, economic, environmental, health-related, scientific, political*
• distinguishes between fact and fiction/opinion/theory	• determines accuracy/currency/reliability of information and ideas	• recognizes underlying bias/assumptions/values in information and ideas
Collaboration and Teamwork	**Collaboration and Teamwork**	**Collaboration and Teamwork**
• works with a range of peer members	• works with a range of peer members	• works with a wide range of peer members
• shares information/opinions/suggestions through group discussion	• shares information/opinions/suggestions, maintaining a balance between speaking and listening	• shares information/opinions/suggestions, maintaining a balance between speaking and listening
• listens to and respects the views of others	• listens to and respects the views of others, requesting clarification as necessary from other group members	• listens to and respects the views of others, requesting clarification as necessary from other group members
Negotiating and Debating	**Negotiating and Debating**	**Negotiating and Debating**
• presents a convincing argument in logical sequence supporting a position adopted on the issue	• presents a convincing argument in logical sequence supporting a position adopted, conveying points in order of importance	• presents a convincing argument in logical sequence supporting a position adopted, conveying points in order of importance and backing each with sound evidence
• provides a relevant response to opposing arguments	• provides a relevant and convincing response to opposing arguments	• provides a relevant and convincing rebuttal to opposing arguments
• speaks clearly so the argument can be understood	• speaks clearly without hesitation so the argument can be understood	• speaks clearly without hesitation so the argument can be understood by all listeners
• establishes a shared understanding of key alternatives and consequences relevant to the issue	• negotiates a shared agreement on preferred alternatives relevant to the issue	• negotiates a shared agreement on preferred alternatives by resolving divergent points of view

ASSESSMENT FRAMEWORK: PRESENTATIONS/REPORTS

INTRODUCTORY	INTERMEDIATE	ADVANCED
The student:	*The student:*	*The student:*
Preparation and Planning • sets goals and follows instructions accurately • responds to directed questions and follows necessary steps to find answers • accesses basic in-school/community information sources • interprets and organizes information into a logical sequence • records information accurately, using correct technical terms • uses time effectively	**Preparation and Planning** • sets goals and describes steps to achieve them • uses personal initiative to formulate questions and find answers • accesses a range of relevant in-school/community resources • interprets, organizes and combines information into a logical sequence • records information accurately with appropriate supporting detail and using correct technical terms • plans and uses time effectively • gathers and responds to feedback regarding approach to task and project status	**Preparation and Planning** • sets goals and describes steps to achieve them • uses personal initiative to formulate questions and find answers • accesses a range of relevant information sources and recognizes when additional information is required • interprets, organizes and combines information in creative and thoughtful ways • records information accurately, using appropriate technical terms and supporting detail • plans and uses time effectively, prioritizing tasks on a consistent basis • assesses and refines approach to task and project status based on feedback and reflection
Presentation • demonstrates effective use of at least one medium of communication: *e.g., Written:* *spelling, punctuation, grammar, basic format* *Oral:* *voice projection, body language* *Audio-Visual:* *techniques, tools* • uses correct grammatical convention and technical terms through proofreading/editing • provides an introduction that describes the purpose of the project • communicates information in a logical sequence • states a conclusion based on a summary of facts • provides a reference list of three or more basic information sources	**Presentation** • demonstrates effective use of at least two communication media: *e.g., Written:* *spelling, punctuation, grammar, format (formal/informal)* *Oral:* *voice projection, body language, appearance* *Audio-Visual:* *techniques, tools, clarity* • maintains acceptable grammatical and technical standards through proofreading and editing • provides an introduction that describes the purpose and scope of the project • communicates ideas into a logical sequence with sufficient supporting detail • states a conclusion by synthesizing the information gathered • provides a reference list that includes five or more relevant information sources	**Presentation** • demonstrates effective use of a variety of communication media: *e.g., Written:* *spelling, punctuation, grammar, format (formal/informal, technical/literary)* *Oral:* *voice projection, body language, appearance, enthusiasm, evidence of prior practice* *Audio-Visual:* *techniques, tools, clarity, speed and pacing* • maintains acceptable grammatical and technical standards through proofreading and editing • provides an introduction that describes the purpose and scope of the project • communicates thoughts/feelings/ideas clearly to justify or challenge a position • states a conclusion by analyzing and synthesizing the information gathered • gives evidence of adequate research through a reference list including seven or more relevant information sources

ASSESSMENT FRAMEWORK: RESEARCH PROCESS

CTSRES

INTRODUCTORY	INTERMEDIATE	ADVANCED
The student:	*The student:*	*The student:*
Preparation and Planning	**Preparation and Planning**	**Preparation and Planning**
• sets goals and follows instructions accurately	• sets goals and establishes steps to achieve them	• sets clear goals and establishes steps to achieve them
• adheres to established timelines	• creates and adheres to useful timelines	• creates and adheres to detailed timelines
• responds to directed questions and follows necessary steps to find answers	• uses personal initiative to formulate questions and find answers	• uses personal initiative to formulate questions and find answers
• uses time effectively	• plans and uses time effectively	• plans and uses time effectively, prioritizing tasks on a consistent basis
Information Gathering and Processing	**Information Gathering and Processing**	**Information Gathering and Processing**
• accesses basic in-school/community information sources	• accesses a range of relevant in-school/community resources	• accesses a range of relevant information sources and recognizes when additional information is required
• uses one or more information-gathering techniques	• uses a range of information-gathering techniques	• demonstrates resourcefulness in collecting data
• interprets and organizes information in a logical sequence	• interprets, organizes and combines information into a logical sequence	• interprets, organizes and combines information in creative and thoughtful ways
• records information accurately, using correct technical terms	• records information accurately with appropriate supporting detail and using correct technical terms	• records information accurately with appropriate supporting detail and using correct technical terms
• distinguishes between fact and fiction/opinion/theory	• determines accuracy/currency/reliability of information sources	• recognizes underlying bias/assumptions/values in information sources
• responds to feedback when current approach is not working	• gathers and responds to feedback regarding approach to the task	• assesses and refines approach to the task and project status based on feedback and reflection
Collaboration and Teamwork	**Collaboration and Teamwork**	**Collaboration and Teamwork**
• cooperates with group members	• cooperates with group members	• cooperates with group members
• shares work appropriately among group members	• shares work appropriately among group members	• shares work appropriately among group members
	• negotiates solutions to problems	• negotiates with sensitivity solutions to problems
		• displays effective communication and leadership skills
Information Sharing	**Information Sharing**	**Information Sharing**
• demonstrates effective use of one or more communication media; *e.g., written, oral, audio-visual*	• demonstrates effective use of two or more communication media; *e.g., written, oral, audio-visual*	• demonstrates effective use of a variety of communication media; *e.g., written, oral, audio-visual*
• communicates information in a logical sequence	• communicates ideas in a logical sequence with sufficient supporting detail	• communicates thoughts/feelings/ideas clearly to justify or challenge a position
• uses correct grammatical convention and technical terms	• maintains acceptable grammatical and technical standards	• maintains acceptable grammatical and technical standards
• cites three or more basic information sources	• cites five or more relevant information sources	• gives evidence of adequate information gathering by citing seven or more relevant information sources

PRESENTATIONS/REPORTS: Introductory Level ENMPRE-1

TASK	OBSERVATION/RATING
Preparation and Planning	4 3 2 1 0 N/A
Content	4 3 2 1 0 N/A
Presenting/Reporting	4 3 2 1 0 N/A

STANDARD IS 1 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ sets goals and follows instruction accurately
☐ responds to directed questions and follows necessary steps to find answers
☐ accesses basic in-school/community information sources
☐ interprets and organizes information into a logical sequence
☐ records information accurately using correct technical terms
☐ uses time effectively

Content

Content (continued)

Presenting/Reporting

☐ demonstrates effective use of one or more communication media:
e.g., Written: spelling, punctuation, grammar, basic format
Oral: voice projection, body language
Audio-Visual: techniques, tools
☐ uses correct grammatical convention and technical terms through proofreading/editing
☐ provides an introduction that describes the purpose of the project
☐ communicates information in a logical sequence
☐ states a conclusion based on a summary of facts
☐ provides a reference list of three or more basic information sources

REFLECTIONS/COMMENTS

PRESENTATIONS/REPORTS: Intermediate Level ENMPRE–2

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Content	4	3	2	1	0	N/A
Presenting/Reporting	4	3	2	1	0	N/A

STANDARD IS 2 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ sets goals and describes steps to achieve them
☐ uses personal initiative to formulate questions and find answers
☐ access a range of relevant in-school/community resources
☐ interprets, organizes and combines information into a logical sequence
☐ records information accurately with appropriate supporting detail and using correct technical terms
☐ plans and uses time effectively
☐ gathers and responds to feedback regarding approach to task and project status

Content

Content (continued)

Presenting/Reporting

☐ demonstrates effective use of at least two communication media:
  e.g., Written: *spelling, punctuation, grammar, format (formal/informal)*
  Oral: *voice projection, body language, appearance*
  Audio-Visual: *techniques, tools, clarity*
☐ maintains acceptable grammatical and technical standards through proofreading and editing
☐ provides an introduction that describes the purpose and scope of the project
☐ communicates ideas into a logical sequence with sufficient supporting detail
☐ states a conclusion by synthesizing the information gathered
☐ provides a reference list that includes five or more relevant information sources

REFLECTIONS/COMMENTS

PRESENTATIONS/REPORTS: Advanced Level

ENMPRE-3

TASK	OBSERVATION/RATING
Preparation and Planning	4 3 2 1 0 N/A
Content	4 3 2 1 0 N/A
Presenting/Reporting	4 3 2 1 0 N/A

STANDARD IS 3 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

- ☐ sets goals and describes steps to achieve them
- ☐ uses personal initiative to formulate questions and find answers
- ☐ accesses a range of relevant information sources and recognizes when additional information is required
- ☐ interprets, organizes and combines information in creative and thoughtful ways
- ☐ records information accurately using appropriate technical terms and supporting detail
- ☐ plans and uses time effectively, prioritizing tasks on a consistent basis
- ☐ accesses and refines approach to task and project status based on feedback and reflection

Content

Content (continued)

Presenting/Reporting

- ☐ demonstrates effective use of a variety of communication media:
  - *e.g.,* Written: *spelling, punctuation, grammar, format (formal/informal, technical/literary)*
  - Oral: *voice projection, body language, appearance, enthusiasm, evidence of prior practice*
  - Audio-Visual: *techniques, tools, clarity, speed and pacing*
- ☐ maintains acceptable grammatical and technical standards through proofreading and editing
- ☐ provides an introduction that describes the purpose and scope of the project
- ☐ communicates thoughts/feelings/ideas clearly to justify or challenge a position
- ☐ states a conclusion by analyzing and synthesizing the information gathered
- ☐ gives evidence of adequate research through a reference list including seven or more relevant information sources

REFLECTIONS/COMMENTS

CAREER SEARCH: Introductory Level ENMCAR-1

TASK	OBSERVATION/RATING
Preparation and Planning	4 3 2 1 0 N/A
Information Gathering and Processing	4 3 2 1 0 N/A
Content	4 3 2 1 0 N/A
Collaboration and Teamwork	4 3 2 1 0 N/A
Information Sharing	4 3 2 1 0 N/A

STANDARD IS 1 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ sets goals and follows instructions accurately
☐ adheres to established timelines
☐ responds to directed questions and follows necessary steps to find answers
☐ uses time effectively

Information Gathering and Processing

☐ accesses basic in-school/community information sources
☐ uses one or more information-gathering techniques
☐ interprets and organizes information into a logical sequence
☐ records information accurately using correct technical terms
☐ distinguishes between fact and fiction/opinion/theory
☐ responds to feedback when current approach is not working

Content

☐ describes one or more career opportunities within the field; e.g.:
  - labour-based
  - technical
  - professional

Content (continued)

☐ identifies and describe occupations relevant to one or more career opportunities; e.g.:
  - nature of the occupation
  - duties of the employee

☐ provides a survey of current employment statistics relevant to one or more careers; e.g.:
  - types of occupations
  - number of employees

☐ identifies entrance requirements and training programs relevant to one or more careers; e.g.:
  - entrance requirements and competencies
  - type of training programs

☐ assesses current and future employment opportunities and trends; e.g.:
  - local and national needs
  - opportunities for advancement

Collaboration and Teamwork

☐ cooperates with group members
☐ shares work appropriately among group members

Information Sharing

☐ demonstrates effective use of one or more communication media;
e.g., written, oral, audio-visual
☐ communicates information in a logical sequence
☐ uses correct grammatical/technical conventions
☐ cites basic information sources

REFLECTIONS/COMMENTS

CAREER SEARCH: Intermediate Level ENMCAR-2

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering and Processing	4	3	2	1	0	N/A
Content	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A

STANDARD IS 2 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ sets goals and establishes steps to achieve them
☐ creates and adheres to useful timelines
☐ uses personal initiative to formulate questions and find answers
☐ plans and uses time effectively

Information Gathering and Processing

☐ accesses a range of relevant in-school/community resources
☐ uses a range of information-gathering techniques
☐ interprets, organizes and combines information into a logical sequence
☐ records information accurately with appropriate supporting detail and using correct technical terms
☐ determines accuracy/currency/reliability of information sources
☐ gathers and responds to feedback regarding approach to the task

Content

☐ describes one or more career opportunities within the field; e.g.:
  - labour-based
  - technical
  - professional

☐ identifies and describes occupations relevant to one or more career opportunities; e.g.:
  - nature of the occupation
  - duties of the employee
  - workplace conditions

Content (continued)

☐ provides a survey of current employment statistics relevant to one or more careers; e.g.:
  - types of occupations
  - number of employees
  - employment trends

☐ identifies entrance requirements and training programs relevant to one or more careers; e.g.:
  - entrance requirements and competencies
  - type and extent of training programs

☐ assesses current and future employment opportunities and trends; e.g.:
  - local, national and international needs
  - opportunities for advancement and/or career change

Collaboration and Teamwork

☐ cooperates with group members
☐ shares work appropriately among group members
☐ negotiates solutions to problems

Information Sharing

☐ demonstrates effective use of two or more communication media:
e.g., written, oral, audio-visual
☐ communicates ideas in a logical sequence with sufficient supporting detail
☐ maintains acceptable grammatical and technical standards
☐ cites relevant information sources

REFLECTIONS/COMMENTS

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CAREER SEARCH: Advanced Level ENMCAR-3

TASK	OBSERVATION/RATING
Preparation and Planning	4 3 2 1 0 N/A
Information Gathering and Processing	4 3 2 1 0 N/A
Content	4 3 2 1 0 N/A
Collaboration and Teamwork	4 3 2 1 0 N/A
Information Sharing	4 3 2 1 0 N/A

STANDARD IS 3 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ sets clear goals and establishes steps to achieve them
☐ creates and adheres to detailed timelines
☐ uses personal initiative to formulate questions and find answers
☐ plans and uses time effectively, prioritizing tasks on a consistent basis

Information Gathering and Processing

☐ accesses a range of relevant information sources and recognizes when additional information is required
☐ demonstrates resourcefulness in collecting data
☐ interprets, organizes and combines information in creative and thoughtful ways
☐ records information accurately with appropriate supporting detail and using correct technical terms
☐ recognizes underlying bias/assumptions/values in information sources
☐ assesses and refines approach to the task and project status based on feedback and reflection

Content

☐ describes one or more career opportunities within the field; e.g.:
  - labour-based
  - technical
  - professional

☐ identifies and describes occupations relevant to one or more career opportunities; e.g.:
  - nature of the occupation
  - duties of the employee
  - workplace conditions
  - salary/wages and employee benefits

Content (continued)

☐ provides a survey of current employment statistics relevant to one or more careers; e.g.:
  - types of occupations
  - number of employees
  - employment trends

☐ identifies entrance requirements and training programs relevant to one or more careers; e.g.:
  - entrance requirements and competencies
  - type and extent of training programs
  - post-secondary institutions

☐ assesses current and future employment opportunities and trends; e.g.:
  - local, national and international needs
  - opportunities for advancement and/or career change
  - opportunities for self-employment and entrepreneurship

Collaboration and Teamwork

☐ cooperates with group members
☐ shares work appropriately among group members
☐ negotiates solutions to problems
☐ displays effective communication and leadership skills

Information Sharing

☐ demonstrates effective use of a variety of communication media:
e.g., written, oral, audio-visual
☐ communicates thoughts/feelings/ideas clearly to justify or challenge a position
☐ maintains acceptable grammatical and technical standards
☐ gives evidence of adequate information gathering by citing relevant information sources

REFLECTIONS/COMMENTS

LAB INVESTIGATIONS: Introductory Level

ENMLAB–1

TASK	OBSERVATION/RATING
Management	4 3 2 1 0 N/A
Teamwork	4 3 2 1 0 N/A
Equipment and Materials	4 3 2 1 0 N/A
Investigative Techniques	4 3 2 1 0 N/A

STANDARD IS 1 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Management
- ☐ prepares self for task
- ☐ organizes and works in an orderly manner
- ☐ carries out instructions accurately
- ☐ uses time effectively

Teamwork
- ☐ cooperates with group members
- ☐ shares work appropriately among group members

Equipment and Materials
- ☐ selects and uses appropriate equipment/materials
- ☐ follows safe procedures/techniques
- ☐ weighs and measures accurately
- ☐ returns clean equipment/materials to storage areas

Investigative Techniques
- ☐ gathers and applies information from one or more sources
- ☐ makes predictions that can be tested
- ☐ sets up and conducts experiments to test a prediction
- ☐ distinguishes between manipulated and responding variables
- ☐ obtains results that can be used to determine if some aspect of the prediction is accurate
- ☐ summarizes important experimental outcomes
- ☐ ______________________________
- ☐ ______________________________
- ☐ ______________________________

REFLECTIONS/COMMENTS

LAB INVESTIGATIONS: Intermediate Level — ENMLAB–2

TASK	OBSERVATION/RATING					
Management	4	3	2	1	0	N/A
Teamwork	4	3	2	1	0	N/A
Equipment and Materials	4	3	2	1	0	N/A
Investigative Techniques	4	3	2	1	0	N/A

STANDARD IS 2 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Management
- ☐ prepares self for task
- ☐ organizes and works in an orderly manner
- ☐ interprets and carries out instructions accurately
- ☐ plans and uses time effectively
- ☐ adheres to routine procedures

Teamwork
- ☐ cooperates with group members
- ☐ shares work appropriately among group members
- ☐ negotiates solutions to problems

Equipment and Materials
- ☐ selects and uses appropriate equipment/materials
- ☐ models safe procedures and techniques
- ☐ weighs and measures accurately
- ☐ practises proper sanitation procedures
- ☐ minimizes waste of materials
- ☐ advises of potential hazards and necessary repairs

Investigative Techniques
- ☐ gathers and applies information from a variety of sources
- ☐ makes predictions that can be tested
- ☐ plans, sets up and conducts experiments to test a prediction
- ☐ identifies and explains manipulated and responding variables
- ☐ obtains accurate results that can be used to confirm or reject the prediction
- ☐ summarizes and applies experimental outcomes
- ☐ ______________________________
- ☐ ______________________________
- ☐ ______________________________
- ☐ ______________________________

REFLECTIONS/COMMENTS

LAB INVESTIGATIONS: Advanced Level ENMLAB–3

TASK	OBSERVATION/RATING
Management	4 3 2 1 0 N/A
Teamwork	4 3 2 1 0 N/A
Equipment and Materials	4 3 2 1 0 N/A
Investigative Techniques	4 3 2 1 0 N/A

STANDARD IS 3 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Management
- ☐ prepares self for task
- ☐ organizes and works in an orderly manner
- ☐ interprets and carries out instructions accurately
- ☐ plans and uses time effectively in a logical sequence
- ☐ displays leadership in adhering to routine procedures
- ☐ attempts to solve problems prior to requesting help

Teamwork
- ☐ cooperates with group members
- ☐ shares work appropriately among group members
- ☐ negotiates with sensitivity solutions to problems
- ☐ displays effective communication skills

Equipment and Materials
- ☐ independently selects and uses appropriate equipment/materials
- ☐ demonstrates concern for safe procedures and techniques
- ☐ weighs and measures accurately and efficiently
- ☐ practises proper sanitation procedures

Use of Equipment and Materials (continued)
- ☐ minimizes waste of materials
- ☐ anticipates potential hazards and emergency response

Investigative Techniques
- ☐ uses relevant information to explain observations
- ☐ makes predictions that can be tested
- ☐ plans, sets up and conducts experiments to test a prediction
- ☐ analyzes relationships among manipulated and responding variables
- ☐ obtains accurate results that confirm or reject the prediction and answers related questions
- ☐ summarizes, applies and evaluates experimental outcomes
- ☐ ______________________
- ☐ ______________________
- ☐ ______________________
- ☐ ______________________

REFLECTIONS/COMMENTS

NEGOTIATION AND DEBATE: Introductory Level ENMNEG–1

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Analyzing Perspectives	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Negotiating and Debating	4	3	2	1	0	N/A

STANDARD IS 1 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ accurately describes an issue on which people disagree
☐ poses an important question regarding the issue
☐ accesses basic in-school/community information sources regarding the issue
☐ uses one or more information-gathering techniques

Analyzing Perspectives

☐ states a position on the issue and logical reasons for adopting that position
☐ explains why the issue is important by presenting examples of possible consequences
☐ clarifies different points of view regarding the issue: *e.g., social, economic, environmental*
☐ distinguishes between fact and fiction/opinion/theory

Collaboration and Teamwork

☐ works with a range of peer members
☐ shares information/opinions/suggestions through group discussion
☐ listens to and respects the views of others

Negotiating and Debating

☐ presents a convincing argument in logical sequence supporting a position adopted on the issue
☐ provides a relevant response to opposing arguments
☐ speaks clearly so the argument can be understood
☐ establishes a shared understanding of key alternatives and consequences relevant to the issue

REFLECTIONS/COMMENTS

NEGOTIATION AND DEBATE: Intermediate Level ENMNEG–2

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Analyzing Perspectives	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Negotiating and Debating	4	3	2	1	0	N/A

STANDARD IS 2 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ accurately describes an issue on which people disagree, explaining areas of disagreement
☐ poses one or more thoughtful questions regarding the issue
☐ accesses a range of relevant in-school/community resources
☐ uses a range of information-gathering techniques

Analyzing Perspectives

☐ states a position on the issue and logical reasons for adopting that position
☐ explains why the issue is important by presenting examples of possible consequences
☐ categorizes different points of view regarding the issue: *e.g., cultural, ethical, economic, environmental, health-related*
☐ determines accuracy/currency/reliability of information and ideas

Collaboration and Teamwork

☐ works with a range of peer members
☐ shares information/opinions/suggestions, and maintains a balance between speaking and listening
☐ listens to and respects the views of others, and requests clarification as necessary from other group members

Negotiating and Debating

☐ presents a convincing argument in logical sequence supporting a position adopted, conveying points in order of importance
☐ provides a relevant and convincing response to opposing arguments
☐ speaks clearly without hesitation so the argument can be understood
☐ negotiates a shared agreement on preferred alternatives relevant to the issue

REFLECTIONS/COMMENTS

NEGOTIATION AND DEBATE: Advanced Level ENMNEG–3

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Analyzing Perspectives	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Negotiating and Debating	4	3	2	1	0	N/A

STANDARD IS 3 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ accurately describes an issue on which people disagree, explaining specific causes of disagreement

☐ poses thoughtful questions regarding the issue

☐ accesses a range of relevant information sources and recognizes when additional information is required

☐ demonstrates resourcefulness in collecting data

Analyzing Perspectives

☐ states a position on the issue and insightful reasons for adopting that position

☐ explains why the issue is important by presenting examples of possible consequences and implications

☐ categorizes different points of view regarding the issue: *e.g., cultural, ethical, economic, environmental, health-related, scientific, political*

☐ recognizes underlying bias/assumptions/values in information and ideas

Collaboration and Teamwork

☐ works with a wide range of peer members

☐ shares information/opinions/suggestions, and maintains a balance between speaking and listening

☐ listens to and respects the views of others, and requests clarification as necessary from other group members

Negotiating and Debating

☐ presents a convincing argument in logical sequence supporting a position adopted, conveying points in order of importance and backing each with sound evidence

☐ provides a relevant and convincing rebuttal to opposing arguments

☐ speaks clearly without hesitation so the argument can be understood by all listeners

☐ negotiates a shared agreement on preferred alternatives by resolving divergent points of view

REFLECTIONS/COMMENTS

ASSESSMENT CRITERIA: Diagrams and Technical Drawings — ENMDRA

TASK	OBSERVATION/RATING
Preparation and Planning	4 3 2 1 0 N/A
Technical Components	4 3 2 1 0 N/A
Information Sharing	4 3 2 1 0 N/A
Collaboration and Teamwork	4 3 2 1 0 N/A

STANDARD IS 1 FOR INTRODUCTORY LEVEL MODULES, 2 FOR INTERMEDIATE LEVEL MODULES, AND 3 FOR ADVANCED LEVEL MODULES

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ sets goals and follows instructions
☐ responds to directed questions and/or follows necessary steps to find answers
☐ uses time effectively
☐ accesses basic in-school/community information sources
☐ interprets and organizes information logically
☐ transfers and/or extrapolates data from print and visual sources to create a diagram/technical drawing
☐ ______________________________

Technical Components

☐ selects and uses appropriate drawing instruments and tools
☐ prepares an accurate outline of the theme to scale
☐ adds detail to the theme as required to ensure recognition and realism
☐ organizes use of space; e.g.:
  - diagram/technical drawing in relation to paper size
  - use of borders
  - position of labels
☐ accurately labels diagram/technical drawing components

Technical Components (continued)

☐ provides an appropriate title for the diagram/technical drawing
☐ demonstrates appropriate use of colour, shading and/or patterns
☐ produces a document free of wrinkles and smudges
☐ maintains appropriate technical standards through proofreading and editing; e.g.:
  - spelling
  - readability
☐ ______________________________

Information Sharing

☐ communicates content of diagram/technical drawing through oral presentation
☐ demonstrates ability to use overlays in presentation
☐ poses questions based on information provided in the diagram/technical drawing
☐ ______________________________

Collaboration and Teamwork

☐ shares work appropriately among group members
☐ respects the views of others
☐ negotiates solutions to problems
☐ ______________________________

REFLECTIONS/COMMENTS

TASK CHECKLIST FOR MAPPING ENMMAP

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Technical Components	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A

STANDARD IS 1 FOR INTRODUCTORY LEVEL MODULES, 2 FOR INTERMEDIATE LEVEL MODULES, AND 3 FOR ADVANCED LEVEL MODULES

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning
- ☐ sets goals and follows instructions
- ☐ responds to directed questions and/or follows necessary steps to find answers
- ☐ uses time effectively
- ☐ accesses basic in-school/community information sources
- ☐ interprets and organizes information logically
- ☐ transfers and/or extrapolates data from print and visual sources to create maps
- ☐ ______________________________

Technical Components
- ☐ prepares an outline of the mapped area to scale
- ☐ provides an appropriate map title
- ☐ records relevant location data
- ☐ provides a map legend that explains:
  - map symbols
  - map scale
- ☐ organizes use of space; e.g.:
  - map size in relationship to paper size
  - use of borders
  - position of legend

Technical Components (continued)
- ☐ demonstrates appropriate use of colour, shading and/or patterns
- ☐ produces a document free of wrinkles and smudges
- ☐ maintains appropriate technical standards through proofreading and editing; e.g.:
  - spelling
  - legibility
- ☐ ______________________________

Information Sharing
- ☐ communicates map content through oral presentation
- ☐ demonstrates ability to use map overlays in presentation
- ☐ poses questions based on information provided in map
- ☐ ______________________________

Collaboration and Teamwork
- ☐ shares work appropriately among group members
- ☐ respects the views of others
- ☐ negotiates solutions to problems
- ☐ ______________________________

REFLECTIONS/COMMENTS

ASSESSMENT CRITERIA: Flow Charts ENMFLO

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Technical Components	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A

STANDARD IS 1 FOR INTRODUCTORY LEVEL MODULES, 2 FOR INTERMEDIATE LEVEL MODULES, AND 3 FOR ADVANCED LEVEL MODULES

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ sets goals and follows instructions
☐ responds to directed questions and/or follows necessary steps to find answers
☐ uses time effectively
☐ accesses basic in-school/community information sources
☐ interprets and organizes information logically
☐ transfers and/or extrapolates data from print and visual sources to create a flow chart
☐ ____________________________________
____

Technical Components

☐ prepares an outline of steps/processes in proper sequence and order
☐ organizes use of space in relation to paper size
☐ selects and uses appropriate drawing instruments and tools
☐ creates a flow chart that:
  - has a definite beginning and end
  - clearly indicates the sequencing of steps/processes

☐ provides arrows to indicate correct sequence of steps/processes

Technical Components (continued)

☐ labels flow chart components as required
☐ provides an appropriate title for the flow chart
☐ demonstrates appropriate use of colour, shading and/or patterns
☐ produces a document free of wrinkles and smudges
☐ maintains appropriate technical standards through proofreading and editing; e.g.:
  - spelling
  - legibility

☐ ____________________________________
____

Information Sharing

☐ communicates content of flow chart through oral presentation
☐ demonstrates ability to use flow chart overlays in presentation
☐ poses questions based on information provided in the flow chart
☐ ____________________________________
____

Collaboration and Teamwork

☐ shares work appropriately among group members
☐ respects the views of others
☐ negotiates solutions to problems
☐ ____________________________________
____

REFLECTIONS/COMMENTS

OBSERVATION CHECKLIST FOR FIELD-BASED INVESTIGATIONS — ENMOBS

Student Name:	Module:	Date:
Destination:		
Contact Person:		
Title/Position of Contact Person:		

PURPOSE OF TRIP (Teacher Defined)

STUDENT EXPECTATIONS (What do you expect to observe/learn?)

ACTUAL OBSERVATIONS (What did you actually observe/learn?)

APPLICATIONS OF PRINCIPLES OF SCIENCE AND TECHOLOGY

REFLECTION ON FIELD INVESTIGATION (What did you find most interesting? least interesting?)

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OBSERVATION CHECKLIST FOR FIELD-BASED INVESTIGATIONS (continued) ENMOBS

OBSERVED CAREERS

Career #1:
Title:
Education Requirements:
Salary Range:
Pros:
Cons:

Career #2:
Title:
Education Requirements:
Salary Range:
Pros:
Cons:

Career #3:
Title:
Education Requirements:
Salary Range:
Pros:
Cons:

Would any of the observed careers appeal to you? Why or why not?

SUMMATIVE CHECKLIST

(to be completed by teacher/supervisor)

The student:

- ☐ identifies trip goals and follows instructions accurately
- ☐ adheres to established itinerary/timelines
- ☐ demonstrates appropriate use of equipment, supplies and/or clothing
- ☐ adheres to acceptable safety standards and behavioural expectations as established by school policy
- ☐ accesses resources available on site
- ☐ uses effective questioning techniques to gather information
- ☐ interprets and records information accurately
- ☐ follows directions/procedures indicated by tour guide and/or as established by industry policy while on site
- ☐ completes all sections of the observation checklist for each field-based investigation.
- ☐
- ☐

PROJECT ASSESSMENT: Technology Design ENMTEC

RATING	ASSESSMENT CRITERIA
	The student:
4 3 2 1 0	**Scheduling Tasks** ☐ sets goals and follows instructions accurately ☐ identifies major tasks and organizes them into a logical sequence ☐ uses time effectively ☐ ____________________
4 3 2 1 0	**Gathering Information** ☐ defines a need within the energy/mineral sector ☐ accesses basic in-school/community resources regarding similar needs and how they were addressed ☐ poses important questions regarding design potential ☐ talks to others in order to clarify ideas ☐ interprets and organizes information into a logical sequence ☐ ____________________
4 3 2 1 0	**Constructing Drawings/Models** ☐ makes reasoned judgements regarding design potential ☐ generates ideas/alternatives regarding a mechanical system and/or process that will address the need ☐ selects the most appropriate alternative based on: – defined needs/problems – efficient use of resources – human and environmental safety ☐ constructs a simple drawing and/or model of the technology that illustrates/demonstrates: – component parts – principles of operation ☐ ____________________
4 3 2 1 0	**Assessing Processes and Outcomes** ☐ assesses the design process and technology outcomes in relation to original needs, efficient use of resources and human/environmental safety ☐ summarizes opportunities and challenges relevant to industry applications of the technology ☐ suggests possible improvements to the design process and/or technology outcomes ☐ ____________________

STANDARD IS 1 FOR INTRODUCTORY LEVEL MODULES, 2 FOR INTERMEDIATE LEVEL MODULES AND 3 FOR ADVANCED LEVEL MODULES

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

N/A Not applicable

REFLECTIONS/COMMENTS

ASSESSMENT CRITERIA: Graphs ENMGRA

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Technical Components	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A

STANDARD IS 1 FOR INTRODUCTORY LEVEL MODULES, 2 FOR INTERMEDIATE LEVEL MODULES AND 3 FOR ADVANCED LEVEL MODULES

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

- ☐ sets goals and follows instructions
- ☐ responds to directed questions and/or follows necessary steps to find answers
- ☐ uses time effectively
- ☐ accesses basic in-school/community information sources
- ☐ interprets and organizes information logically
- ☐ transfers and/or extrapolates data from print and visual sources to create a graph
- ☐ ____________________

Technical Components

- ☐ selects a type of graph suited to the information being communicated (e.g., bar, line, picture)
- ☐ organizes use of space; e.g.:
  - location of axes
  - use of borders
  - presentation of symbols/descriptors in relation to available space
- ☐ clearly identifies and labels axes
- ☐ selects an appropriate scale and performs accurate calculations
- ☐ plots graph as required to accurately communicate data

Technical Components (continued)

- ☐ demonstrates appropriate use of colour, shading and/or patterns
- ☐ provides an appropriate title for the graph
- ☐ produces a document free of wrinkles and smudges
- ☐ maintains appropriate technical standards through proofreading and editing; e.g.:
  - spelling
  - legibility
- ☐ ____________________

Information Sharing

- ☐ explains purpose/theme of the graph through oral presentation
- ☐ demonstrates ability to use transparencies/overlays in presentation
- ☐ poses questions based on information provided in graph
- ☐ ____________________

Collaboration and Teamwork

- ☐ shares work appropriately among group members
- ☐ respects the views of others
- ☐ negotiates solutions to problems
- ☐ ____________________

REFLECTIONS/COMMENTS

REFLECTION GUIDE FOR ENVIRONMENTAL RESPONSIBLITY/CITIZENSHP ENMREF

JOURNAL ENTRY: DATE:	#1	#2	#3	#4	#5
Preparation and Planning	4 3 2 1 0 N/A	4 3 2 1 0 N/A	4 3 2 1 0 N/A	4 3 2 1 0 N/A	4 3 2 1 0 N/A
Comprehension and Analysis	4 3 2 1 0 N/A	4 3 2 1 0 N/A	4 3 2 1 0 N/A	4 3 2 1 0 N/A	4 3 2 1 0 N/A
Evaluation and Decision-Making	4 3 2 1 0 N/A	4 3 2 1 0 N/A	4 3 2 1 0 N/A	4 3 2 1 0 N/A	4 3 2 1 0 N/A
Presenting and Reporting	4 3 2 1 0 N/A	4 3 2 1 0 N/A	4 3 2 1 0 N/A	4 3 2 1 0 N/A	4 3 2 1 0 N/A
TOTAL:					

STANDARD: Address criteria for reflection to a standard of 1 for introductory level modules, 2 for intermediate level modules and 3 for advanced level modules.

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

CRITERIA FOR SUMMATIVE REFLECTION

The student:

Preparation and Planning
- ☐ sets goals and follows instructions accurately
- ☐ establishes a schedule of activities for completing each journal entry
- ☐ accesses in-school/community sources of information
- ☐ plans and uses time effectively

Comprehension and Analysis
- ☐ considers the impact of one or more personal attitudes, actions and/or lifestyles on sustainability and the environment
- ☐ identifies relevant social, economic and/or environmental perspectives
- ☐ explains potential sources of conflict regarding personal attitudes, actions and/or lifestyle; *e.g.: Who? What? Where? Why*?

Evaluation and Decision Making
- ☐ balances information and values
- ☐ demonstrates respect for and considers the views of others
- ☐ considers alternatives for environmental citizenship on the basis of their consequences and implications for sustainable development and the environment
- ☐ reflects on strengths of personal actions and lifestyle within the context of environmental responsibility, and suggests areas that need improvement

Presenting and Reporting
- ☐ uses correct grammatical convention and technical terms through proofreading/editing
- ☐ communicates information and ideas clearly in a logical sequence
- ☐ provides an introduction that states the purpose of the journal entry
- ☐ states a conclusion based on a summary of information and ideas

ASSESSMENT CRITERIA: Proposal for Environmental Action	**ENMPRO**

PROPOSAL	RATIONALE	INTENDED OUTCOMES
1. Personal Action		
2. Leadership Role		

Rating Scale

The student:

4 demonstrates a thorough understanding of the need for action. Problems are solved independently in effective and creative ways. The rationale and outcomes are based on analysis of data and supported with sufficient detail.

3 demonstrates an understanding of the need for action. Issues are effectively addressed in a self-directed manner. The rationale and outcomes are based on analysis of data and supported with some detail.

2 demonstrates a general understanding of the need for action. Issues are addressed with guidance. The rationale and outcomes are based on limited data and detail.

1 demonstrates partial understanding of the need for action. Attempts a proposal but the rationale and/or outcomes are general or unsupported.

0 fails to understand the need for action or does not attempt a proposal.

N/A Not applicable

DIRECTIONS

THE STUDENT PROVIDES TWO PROPOSALS FOR ENVIRONMENTAL ACTION - ONE BASED ON PERSONAL/INDIVIDUAL ACTION, THE OTHER INVOLVING A LEADERSHIP ROLE. EACH PROPOSAL TO BE SUPPORTED WITH A RATIONALE AND INTENDED OUTCOMES.

STANDARD

EACH PROPOSAL TO BE COMPLETED TO A STANDARD OF 1 FOR INTRODUCTORY MODULES, 2 FOR INTERMEDIATE MODULES, AND 3 FOR ADVANCED MODULES

ASSESSMENT CRITERIA: Letters of Support or Concern ENMLET

RATING	ASSESSMENT CRITERIA
	The student:
4 3 2 1 0	**Preparation and Planning** ☐ identifies a specific issue regarding resource management/environmental citizenship ☐ talks to others in order to clarify ideas ☐ accesses basic in-school/community resources regarding the issue ☐ identifies appropriate individuals/agencies to contact ☐ establishes a position on the issue ☐ ______________________________
4 3 2 1 0	**Writing the Letter** ☐ clearly states a position on the issue and a rationale for adopting that position ☐ considers the implications of various approaches for dealing with the issue ☐ cites references to support information/views ☐ maintains an appropriate tone of communication ☐ requests a response to the letter ☐ uses correct grammatical and technical conventions ☐ demonstrates proofreading and editing skills ☐ ______________________________
4 3 2 1 0	**Critiquing the Response** ☐ identifies important elements of the response: – acknowledgement of support or concern – statement of position and rationale – reference to supporting information/views – comments regarding future options/alternatives ☐ assesses quality of the response based on: – logical development of ideas – quality/quantity of supporting information and views – tone of communication ☐ suggests possible improvements to the response and original letter ☐ ______________________________

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

REFLECTIONS/COMMENTS

GUIDE TO CRITIQUING MEDIA INFORMATION — ENMMED

Student Name:	Date:
Media Source:	
Method of Presentation:	
Issue/Topic:	

GOALS/OBJECTIVES OF THE MEDIA PRESENTATION

SUMMARY OF INFORMATION PRESENTED (e.g., topic/issue, position taken, supporting detail, implications/consequences)

QUALITY/OBJECTIVITY OF INFORMATION PRESENTED (e.g., bias-balance, currency/reliability, logic/reasoning)

PERSONAL IMPACT OF MEDIA PRESENTATION

Yes	No	ASSESSING QUALITY/OBJECTIVITY
		The media presentation:
☐	☐	clearly describes a topic/issue/position taken with sufficient supporting detail
☐	☐	demonstrates bias-balance in the manner of presentation
☐	☐	makes reference to different points of view (e.g., social, economic, environmental)
☐	☐	distinguishes between fact and fiction/opinion/theory
☐	☐	references current and reliable sources for information and ideas
☐	☐	draws valid conclusions based on analysis/synthesis of information
☐	☐	

Rating Scale

The student:

4	exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.
3	meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.
2	meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.
1	meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.
0	has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.
N/A	Not applicable

LOG/VERIFICATION OF VOLUNTEER WORK **ENMLOG–VOL(a)**

Student Name: ______________ Module: ______________ Supervisor: ______________

Volunteer Service Provided: ______________ Date: ______________

Volunteer Site/Location: ______________

Time Volunteered: ______________

Description of Volunteer Service:

(a) goals/tasks established by supervisor: ______________

(b) tasks completed by volunteer: ______________

Observations/Insights Gained From Volunteer Work:

Comments: ______________

(Student's Signature)

(Supervisor's Signature) (Supervisor's Phone Number)

Volunteer Service Provided: ______________ Date: ______________

Volunteer Site/Location: ______________

Time Volunteered: ______________

Description of Volunteer Service:

(a) goals/tasks established by supervisor: ______________

(b) tasks completed by volunteer: ______________

Observations/Insights Gained From Volunteer Work:

Comments: ______________

(Student's Signature)

(Supervisor's Signature) (Supervisor's Phone Number)

STANDARD: The student completes all sections of the log/verification for five hours of volunteer work

LOG/VERIFICATION FOR VOLUNTEER WORK (PART 1) ENMLOG–VOL(b)

PREPARATION AND PLANNING	YES	NO	N/A
The student:			
• identifies personal and environmental goals for volunteer work	☐	☐	
• prepares a list of potential environmental, industry and/or professional organizations to contact regarding volunteer work	☐	☐	☐
• contacts an organization regarding desire to volunteer, sharing personal information through interview and/or résumé	☐	☐	☐
• obtains satisfactory placement for volunteer work	☐	☐	
• establishes a schedule of dates and times for volunteer work	☐	☐	
• identifies and adheres to school policies/ procedures regarding off-campus activities	☐	☐	

VERIFYING AND REFLECTING	YES	NO	N/A
The student:			
• submits a log of tasks undertaken for each volunteer site and/or work experience (see Part 1)	☐	☐	
• performs volunteer tasks in a satisfactory manner (see Part 2)	☐	☐	
• provides a brief written summary of personal observations/impressions regarding the volunteer experience: – contribution of tasks undertaken to environmental stewardship – problems encountered and suggested solutions – recommendations regarding future volunteer experiences	☐	☐	

STANDARD IS 2 IN EACH APPLICABLE TASK AREA

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

N/A Not Applicable

REFLECTIONS/COMMENTS

LOG/VERIFICATION FOR VOLUNTEER WORK (PART 2) **ENMLOG–VOL(b)**

STUDENT LOG OF ACTIVITIES

Student's Name: ______________________________

Sponsoring Organization: __________________________

Supervisor's Name/Position: ____________________

Date(s) of Volunteer Work: ________________________

Time(s)/Duration of Volunteer Work: _________________

____

Volunteer Tasks Undertaken:

____________________ **Student's Signature**

____________________ **Date**

VERIFICATION BY SUPERVISOR

The student:

- ☐ follows instructions and adheres to guidelines
- ☐ uses time effectively
- ☐ demonstrates concern for safe procedures and techniques
- ☐ anticipates and advises of potential hazards
- ☐ works cooperatively with other group members

Supervisor's Comments:

____________________ **Supervisor's Signature**

____________________ **Date**

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ASSESSMENT CRITERIA: Geological Time Charts ENM1010-1

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Technical Components	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A

STANDARD IS 1 FOR EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ sets goals and follows instructions
☐ responds to directed questions and/or follows necessary steps to find answers
☐ uses time effectively
☐ accesses basic in-school/community information sources
☐ interprets and organizes information logically
☐ transfers and/or extrapolates data from print and visual sources to create time chart
☐ ______________________________

Technical Components

☐ prepares a chart that outlines the eras and periods of geological time
☐ provides an appropriate chart title
☐ illustrates and records life characteristic of each era/period in time
☐ provides a topographical description of what Alberta was like for each era/period of time
☐ organizes use of space; e.g.:
  - geological chart in relation to paper size
  - use of borders
  - presentation of symbols/descriptors in relation to available space

Technical Components (continued)

☐ demonstrates appropriate use of colour, shading and/or patterns
☐ produces a document free of wrinkles and smudges
☐ maintains appropriate technical standards through proofreading and editing; e.g.:
  - spelling
  - legibility
☐ ______________________________

Information Sharing

☐ communicates chart content through oral presentation
☐ demonstrates ability to use chart overlays in presentation
☐ poses questions based on information provided in chart
☐ ______________________________

Collaboration and Teamwork

☐ shares work appropriately among group members
☐ respects the views of others
☐ negotiates solutions to problems
☐ ______________________________

REFLECTIONS/COMMENTS

LAB INVESTIGATIONS: Rock Structures ENM1010–2

TASK	OBSERVATION/RATING					
Management	4	3	2	1	0	N/A
Teamwork	4	3	2	1	0	N/A
Equipment and Materials	4	3	2	1	0	N/A
Investigative Techniques	4	3	2	1	0	N/A

STANDARD IS 1 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Management
- ☐ prepares self for task
- ☐ organizes and works in an orderly manner
- ☐ carries out instructions accurately
- ☐ uses time effectively

Teamwork
- ☐ cooperates with group members
- ☐ shares work appropriately among group members

Equipment and Materials
- ☐ selects and uses appropriate equipment/materials
- ☐ follows safe procedures/techniques
- ☐ measures accurately
- ☐ returns clean equipment/materials to storage areas

Investigative Techniques
- ☐ gathers and applies information to determine physical characteristics of rock and mineral samples
- ☐ plans and conducts tests to determine physical similarities and differences among three or more hydrocarbon-bearing samples common in Alberta (e.g., dolomite, limestone, sandstone, shale)

Investigative Techniques (continued)
- ☐ prepares a chart describing similarities and differences among three or more hydrocarbon-bearing samples
- ☐ plans and conducts tests to determine physical similarities and differences among six or more of Alberta's metallic and/or industrial minerals (e.g., coal, copper, iron, limestone, magnesium, sulphur, clay, salt/potash, aggregates)
- ☐ prepares a chart describing similarities and differences among six or more metallic and/or industrial minerals with respect to:
  - colour
  - lustre
  - crystal structure
  - streak
- ☐ summarizes investigative results in explaining:
  - potential capacity of rock samples to bear hydrocarbons
  - potential value of mineral samples to the industry sector
- ☐ ______________________________
  ____
- ☐ ______________________________
  ____

REFLECTIONS/COMMENTS

SAMPLE LAB INVESTIGATIONS

- *Earth Science Workshop Series* (Book 1, 2 and 3), Cambridge Publishing Company
- *Science Directions 8* (Unit Four: The Earth's Crust), John Wiley & Sons

ISSUE ANALYSIS: Impacts of Energy/Mineral Development ENM1010–3

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Analyzing Perspectives	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Evaluating Choices/Making Decisions	4	3	2	1	0	N/A

STANDARD IS 1 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning
☐ accurately describes an issue on which people disagree regarding an energy or mineral development
☐ poses an important question regarding the impact of the development on the environment and people who live there
☐ accesses basic in-school/community information sources regarding the issue
☐ uses one or more information-gathering techniques

Analyzing Perspectives
☐ clarifies different points of view regarding the issue:
e.g., social, economic, environmental
☐ states a position on the issue and logical reasons for adopting that position
☐ states an opposing position on the issue and logical reasons for adopting that position
☐ identifies sources of conflict among different positions
☐ distinguishes between fact and fiction/opinion/theory

Collaboration and Teamwork
☐ shares information and ideas appropriately among group members
☐ respects the views of others

Evaluating Choices/Making Decisions
☐ identifies useful alternatives regarding the energy or mineral development
☐ establishes criteria for assessing each alternative:
e.g., social, economic, environmental
☐ ____________________________________
____
☐ selects an appropriate alternative regarding the energy or mineral development based on established criteria
☐ reflects on strengths/weaknesses of choices and/or decisions made by considering consequences; e.g.:
- sustainable development
- other quality of life factors

☐ ____________________________________
____
☐ communicates information in a logical sequence to justify choices/decisions made
☐ ____________________________________
____

REFLECTIONS/COMMENTS

ISSUE ANALYSIS: Sustainable Energy Development ENM1050–1

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Analyzing Perspectives	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Evaluating Choices/Making Decisions	4	3	2	1	0	N/A

STANDARD IS 1 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning
- ☐ accurately describes an issue on which people disagree regarding use of renewable/nonrenewable energy
- ☐ poses an important question regarding the impact of energy use on the environment and people who live there
- ☐ accesses basic in-school/community information sources regarding the issue
- ☐ uses one or more information-gathering techniques

Analyzing Perspectives
- ☐ clarifies different points of view regarding the issue:
  e.g., social, economic, environmental
- ☐ states a position on the issue and logical reasons for adopting that position
- ☐ states an opposing position on the issue and logical reasons for adopting that position
- ☐ identifies sources of conflict among different positions
- ☐ distinguishes between fact and fiction/opinion/theory

Collaboration and Teamwork
- ☐ shares information and ideas appropriately among group members
- ☐ respects the views of others

Evaluating Choices/Making Decisions
- ☐ identifies potential options for dealing with the issues that further sustainable energy supply
- ☐ establishes criteria for assessing each alternative:
  e.g., social, economic, environmental
- ☐ ______________________________
- ☐ develops a plan for dealing with the issue, based on established criteria, which furthers sustainable energy supply
- ☐ reflects on strengths/weaknesses of the plan by considering consequences; e.g.:
  - sustainable development
  - other quality of life factors
- ☐ ______________________________
- ☐ communicates information in a logical sequence to justify choices/decisions made
- ☐ ______________________________

REFLECTIONS/COMMENTS

BEST COPY AVAILABLE

TASK CHECKLIST: Planning and Implementing a Recycling Project ENM1090–1

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering	4	3	2	1	0	N/A
Implementing the Project	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A

STANDARD IS 1 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ develops a rationale for/awareness of the recycling project

☐ sets goals and establishes steps to achieve them

☐ creates and follows timelines

☐ plans and uses time effectively

Information Gathering

☐ accesses relevant sources of information in the home, school and/or community

☐ identifies recyclable materials and potential products to be made through the recycling process

☐ establishes recycling steps, techniques and processes

☐ identifies requirements regarding:
  - location
  - facility
  - equipment and materials

☐ considers costs and benefits relevant to the recycling project

Implementing the Project

☐ accesses necessary facilities, equipment and materials

☐ advertises and promotes the recycling project within the home, school and/or community

☐ demonstrates personal initiative in assuming and delegating responsibilities

☐ successfully implements the recycling project

☐ monitors the recycling project and modifies processes/responsibilities as required to achieve goals

☐ ______________________________

____

Collaboration and Teamwork

☐ works with a range of peer members

☐ shares work and responsibilities among group members

☐ shares information/suggestions through group discussion

☐ negotiates solutions to problems

☐ solicits the support of others

☐ ______________________________

____

REFLECTIONS/COMMENTS

SAMPLE RECYCLING PROJECTS:

- Paper Recycling
- Making and Selling Compost
- Recycling Tires into Rubber Mats
- Recycled Jewellery
- Note Pads From Scrap Paper

RESOURCES:

- *Somebody Should Do Something About This! A Teacher's Resource Book on Energy and the Environment*
- *What We Can Do For Our Environment: Hundreds of Things to Do Now*

RESEARCH PROCESS: Recycling Systems ENM1090–2

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering and Processing	4	3	2	1	0	N/A
Content	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A

STANDARD IS 1 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

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1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ sets goals and follows instructions accurately

☐ adheres to established timelines

☐ responds to directed questions and follows necessary steps to find answers

☐ uses time effectively

Information Gathering and Processing

☐ accesses basic in-school/community information sources

☐ uses one or more information-gathering techniques

☐ interprets and organizes information in a logical sequence

☐ records information accurately using correct technical terms

☐ distinguishes between fact and fiction/opinion/theory

☐ responds to feedback when current approach is not working

Content

☐ identifies the products and/or services provided by a recycling industry

☐ describes inputs to processing within the industry; e.g.:
- commodity inputs/raw materials
- financial resources
- human and natural resources
- technology

☐ explains major stages and steps in recycling the waste material; e.g.:
- collecting and sorting
- processing/product formation
- transportation and storage

Content (continued)

☐ explains techniques used to control quality within the recycling industry; e.g.:
- inspection/sorting of raw materials
- product quality and uniformity

☐ describes transportation and storage requirements, and their impact on industry location and recycling costs

☐ identifies environmental standards and concerns that affect the recycling industry; e.g.:
- water, soil and air quality
- use of energy and other resources

☐ considers factors that affect the economic viability of the recycling industry; e.g.:
- collecting, sorting, processing and transportation costs
- potential markets for the product or service
- relative cost of waste disposal by other means

☐ ______________________________
____

Collaboration and Teamwork

☐ cooperates with group members

☐ shares work appropriately among group members

Information Sharing

☐ demonstrates effective use of one or more communication media:
e.g., written, oral, audio-visual

☐ communicates ideas in a logical sequence

☐ uses correct grammatical convention and technical terms

☐ cites three or more basic information sources

REFLECTIONS/COMMENTS

RESEARCH PROCESS: Environmental Impacts ENM1100–1

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering and Processing	4	3	2	1	0	N/A
Content	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A

STANDARD IS 1 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ sets goals and follows instructions accurately
☐ adheres to established timelines
☐ responds to directed questions and follows necessary steps to find answers
☐ uses time effectively

Information Gathering and Processing

☐ accesses basic in-school/community information sources
☐ uses one or more information-gathering techniques
☐ interprets and organizes information in a logical sequence
☐ records information accurately using correct technical terms
☐ distinguishes between fact and fiction/opinion/theory
☐ responds to feedback when current approach is not working

Content

☐ identifies environmental factors related to the extraction, processing and use of an energy or mineral resource; e.g.:
  – land use practices
  – soil, water and air quality
  – wildlife habitat and natural areas
☐ makes forecasts regarding environmental change at global levels caused by resource development; e.g.:
  – deforestation
  – greenhouse effect
  – acid deposition

Content (continued)

☐ identifies short- and long-term benefits and costs related to the extraction, processing and use of an energy/mineral resource
☐ explains strategies used by industry to protect the environment; e.g.:
  – waste/emission control
  – soil, water and air quality sampling
  – wildlife/habitat protection
  – site reclamation
  – compliance with environmental policy
  – research and development
☐ cites an environmental "success story" with respect to an energy/mineral industry
☐ ______________________________
____

Collaboration and Teamwork

☐ cooperates with group members
☐ shares work appropriately among group members

Information Sharing

☐ demonstrates effective use of one or more communication media:
e.g., written, oral, audio-visual
☐ communicates ideas in a logical sequence
☐ uses correct grammatical convention and technical terms
☐ cites three or more basic information sources

REFLECTIONS/COMMENTS

ASSESSMENT CRITERIA: A Conservation Strategy ENM1100–2

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Content	4	3	2	1	0	N/A
Presenting/ Reporting	4	3	2	1	0	N/A

STANDARD IS 1 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

ASSESSMENT CRITERIA

The student:

Preparation and Planning

☐ sets goals and follows instructions accurately
☐ responds to directed questions and follows necessary steps to find answers
☐ accesses basic in-school/community information sources
☐ interprets and organizes information into a logical sequence
☐ records information accurately using correct technical terms
☐ uses time effectively

Content

☐ provides definitions and examples of conservation and preservation
☐ describes current demands placed on an energy/ mineral resource in Alberta and Canada; e.g.:
  – residential
  – commercial
  – industrial
☐ provides a rationale for conserving the resource based on:
  – patterns/trends in consumption
  – sustainable development
  – environmental impact

Content (continued)

☐ outlines major components of a strategy for conserving the resource; e.g.:
  – reduced consumption
  – energy alternatives/material substitutes
☐ explains how specific conservation practices foster sustainable development and benefit society
☐ identifies supporting agencies/structures at local, national and international levels; e.g.:
  – public
  – private
☐ ______________________________
____

Presenting/Reporting

☐ demonstrates effective use of one or more communication media:
  e.g., Written: spelling, punctuation, grammar basic format
  Oral: voice projection, body language
  Audio-Visual: techniques, tools
☐ uses correct grammatical convention and technical terms through proofreading/editing
☐ provides an introduction that describes the purpose of the project
☐ communicates information in a logical sequence
☐ states a conclusion based on a summary of facts
☐ provides a reference list of three or more basic information sources

REFLECTIONS/COMMENTS

GUIDE TO INFERENCES: Personal Impact on Resources ENM1100–3

INFERENCE

Definition: to derive a conclusion from facts or premises

Synonyms: infer, deduce, deduct, draw, gather , judge

Criteria for Assessing Inferences

Inferences made in introductory-level modules should not be assessed as right or wrong. Instead, inferences should be considered valid if they are communicated in a logical sequence with sufficient supporting detail. The type of information used to derive a conclusion is important in determining the validity of the inference.

Each inference regarding the impact of lifestyle practices on an energy or mineral resource should provide:

☐ a statement of the situation
☐ relevant facts and detail that support more than one point of view:
  e.g., cultural, ethical, economic, environmental, health-related
☐ a logical sequence of ideas that lead to a conclusion
☐ a conclusion that is realistic in light of the information gathered

Journal of Lifestyle Practices

The journal will include 10 or more entries that describe lifestyle practices that affect an energy or mineral resource. Activities may be seasonal in nature, yet need to be of sufficient duration to permit reflection on their consequences. Each journal entry should describe:

☐ the nature of the activity
☐ a rationale for participating in the activity
☐ inferences regarding both short- and long-term consequences for the resource and/or environment.

Journal entries may reference activities that:

- involve direct consumption of energy or minerals; e.g.:
  - using an automobile
  - turning on an electric light
- influence energy or mineral resources in indirect ways.

Reference: *A Primer on Environmental Citizenship,* Environment Canada

STANDARD: Complete 10 journal entries that address criteria for inferences to a standard of 1 on the rating scale.

RATING SCALE

The student:

4	3	2	1	0
exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.	meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.	meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.	meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.	has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

CONSERVATION CONTRACT

I, ______________________ on this ______day in the month of __________________ in the year of ______________, do declare my commitment to pursue lifestyle practices that foster conservation and responsible use of energy and minerals.

According to the terms of this contract, I will:

- demonstrate commitment to responsible lifestyle practices, including
  a)____
  b)____
  c)____
  d)____
  e)____
- maintain a "*Conservation Log*" of daily activities that support environmental stewardship.

Signed______________________ Witness______________________

RESEARCH PROCESS: Administration of Energy/Mineral Resources ENM2010–1

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering and Processing	4	3	2	1	0	N/A
Content	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A

STANDARD IS 2 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ sets goals and establishes steps to achieve them
☐ creates and adheres to useful timelines
☐ uses personal initiative to formulate questions and find answers
☐ plans and uses time effectively

Information Gathering and Processing

☐ accesses a range of relevant in-school/community resources
☐ uses a range of information-gathering techniques
☐ interprets, organizes and combines information into a logical sequence
☐ records information accurately with appropriate supporting detail and using correct technical terms
☐ determines accuracy/currency/reliability of information sources
☐ gathers and responds to feedback regarding approach to the task

Content

☐ describes changes that have occurred in the ownership and administration of energy and mineral resources in Alberta; e.g.:
  - private ownership of mineral rights
  - federal jurisdiction
  - provincial status
  - Aboriginal lands and Native rights
  - *Natural Resources Transfer Act*

Content (continued)

☐ constructs a timeline of historical changes in administrative policies governing ownership and development of Alberta's energy and mineral resources
☐ describes the extent to which different types of resource ownership exist in Alberta today; e.g.:
  - public (provincial and federal Crown ownership)
  - private ("freehold") ownership
☐ constructs maps depicting land ownership areas in Alberta today
☐ constructs graphs depicting land ownership distribution in Alberta today
☐ ____________________

Collaboration and Teamwork

☐ cooperates with group members
☐ shares work appropriately among group members
☐ negotiates solutions to problems

Information Sharing

☐ demonstrates effective use of two or more communication media:
e.g., written, oral, audio-visual
☐ communicates ideas in a logical sequence with sufficient supporting detail
☐ maintains acceptable grammatical and technical standards
☐ cites five or more relevant information sources

REFLECTIONS/COMMENTS

RESEARCH PROCESS: Conventional Oil and Gas Exploration ENM2020–1

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering and Processing	4	3	2	1	0	N/A
Content	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A

STANDARD IS 2 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ sets goals and establishes steps to achieve them
☐ creates and adheres to useful timelines
☐ uses personal initiative to formulate questions and find answers
☐ plans and uses time effectively

Information Gathering and Processing

☐ accesses a range of relevant in-school/community resources
☐ uses a range of information-gathering techniques
☐ interprets, organizes and combines information into a logical sequence
☐ records information accurately with appropriate supporting detail and using correct technical terms
☐ determines accuracy/currency/reliability of information sources
☐ gathers and responds to feedback regarding approach to the task

Content

☐ explains basic theories and/or principles regarding the formation and migration of conventional underground oil and gas deposits; e.g.:
  - theories of origin/formation
  - source rock and migration
  - difference between porosity and permeability

☐ provides illustrations of subsurface rock structures capable of trapping oil and gas deposits; e.g.:
  - anticlinal trap
  - fault trap
  - stratigraphic trap
  - reef trap

Content (continued)

☐ provides information regarding probable reserves of oil and gas in major sedimentary basin areas of Western Canada

☐ describes the characteristics of specific sedimentary formations in Alberta; e.g.:
  - name of formation (e.g., Pembina, Leduc)
  - location on a map
  - type of hydrocarbon-bearing rock
  - probable depth and extent

☐ describes techniques used to gather information about subsurface rock formations within a basin prior to seismic and drilling operations; e.g.:
  - first-hand observation of surface features
  - research of existing data
  - applications of aerial surveys and satellite imagery

☐ explains applications of seismic and drilling technology in determining the composition of subsurface rock and mapping potential oil- and gas-bearing formations

☐ ______________________________
____

Collaboration and Teamwork

☐ cooperates with group members
☐ shares work appropriately among group members
☐ negotiates solutions to problems

Information Sharing

☐ demonstrates effective use of two or more communication media:
e.g., written, oral, audio-visual
☐ communicates ideas in a logical sequence with sufficient supporting detail
☐ maintains acceptable grammatical and technical standards
☐ cites five or more relevant information sources

RESEARCH PROCESS: Exploration of Nonconventional Hydrocarbons ENM2030-1

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering and Processing	4	3	2	1	0	N/A
Content	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A

STANDARD IS 2 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning
- ☐ sets goals and establishes steps to achieve them
- ☐ creates and adheres to useful timelines
- ☐ uses personal initiative to formulate questions and find answers
- ☐ plans and uses time effectively

Information Gathering and Processing
- ☐ accesses a range of relevant in-school/community resources
- ☐ uses a range of information-gathering techniques
- ☐ interprets, organizes and combines information into a logical sequence
- ☐ records information accurately with appropriate supporting detail and using correct technical terms
- ☐ determines accuracy/currency/reliability of information sources
- ☐ gathers and responds to feedback regarding approach to the task

Content
- ☐ explains basic theories and/or principles regarding the formation of oil sands, heavy oil or coal deposits; e.g.:
  - theories of origin/formation
  - surface and subsurface geology
  - difference between porosity and permeability
- ☐ provides illustrations of surface and subsurface rock structures capable of containing oil sands, heavy oil or coal deposits
- ☐ identifies major geographical areas of Alberta in which oil sands, heavy oil or coal deposits are located, and relates geographic patterns to theories of origin

Content (continued)
- ☐ describes techniques used to gather information about potential oil- or coal-bearing formations prior to seismic and drilling operations; e.g.:
  - first-hand observation of surface features
  - research of existing data
  - applications of aerial surveys and satellite imagery
- ☐ explains applications of seismic and drilling technology in determining the composition of subsurface rock and mapping potential oil- and coal-bearing formations
- ☐ describes techniques used to estimate Alberta's recoverable heavy oil, bitumen or coal
- ☐ compares known reserves of energy stored in oil sands and coal to known reserves of energy available through other fossil fuels in Alberta, Canada and the world
- ☐ ____________________________________

Collaboration and Teamwork
- ☐ cooperates with group members
- ☐ shares work appropriately among group members
- ☐ negotiates solutions to problems

Information Sharing
- ☐ demonstrates effective use of two or more communication media:
  e.g., written, oral, audio-visual
- ☐ communicates ideas in a logical sequence with sufficient supporting detail
- ☐ maintains acceptable grammatical and technical standards
- ☐ cites five or more relevant information sources

RESEARCH PROCESS: Exploration of Mineral Deposits ENM2040–1

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering and Processing	4	3	2	1	0	N/A
Content	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A

STANDARD IS 2 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ sets goals and establishes steps to achieve them
☐ creates and adheres to useful timelines
☐ uses personal initiative to formulate questions and find answers
☐ plans and uses time effectively

Information Gathering and Processing

☐ accesses a range of relevant in-school/community resources
☐ uses a range of information-gathering techniques
☐ interprets, organizes and combines information into a logical sequence
☐ records information accurately with appropriate supporting detail and using correct technical terms
☐ determines accuracy/currency/reliability of information sources
☐ gathers and responds to feedback regarding approach to the task

Content

☐ explains basic theories and/or principles regarding the formation of metallic and nonmetallic minerals and structural materials; e.g.:
  - theories of origin/formation
  - surface and subsurface geology

☐ provides illustrations of surface and subsurface rock structures in which metallic and industrial minerals are commonly found
☐ describes the mineral potential of major geological areas of Alberta; e.g.:
  - Precambrian Shield
  - Interior Plain
  - Foothills
  - Rocky Mountains

Content (continued)

☐ identifies geographical areas of Alberta in which occurrences of specific minerals are known to exist, and relates geographic patterns to theories of origin
☐ describes techniques used to gather information about potential mineral-bearing formations prior to seismic mapping and drilling operations; e.g.:
  - first-hand observation of surface features
  - research of existing data
  - applications of aerial surveys and satellite imagery

☐ explains applications of seismic and drilling technology in determining the composition of subsurface rock and establishing the presence of mineral deposits
☐ suggests reasons why the potential of the mineral industry in Alberta has not been fully established, nor have known deposits of minerals been fully developed
☐ summarizes recent developments in Alberta regarding the exploration of gold, diamonds and base-metals
☐ ______________________________
____

Collaboration and Teamwork

☐ cooperates with group members
☐ shares work appropriately among group members
☐ negotiates solutions to problems

Information Sharing

☐ demonstrates effective use of two or more communication media:
e.g., written, oral, audio-visual
☐ communicates ideas in a logical sequence with sufficient supporting detail
☐ maintains acceptable grammatical and technical standards
☐ cites five or more relevant information sources

RESEARCH PROCESS: Hydrocarbon Processing ENM2060-1

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering and Processing	4	3	2	1	0	N/A
Content	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A

STANDARD IS 2 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ sets goals and establishes steps to achieve them
☐ creates and adheres to useful timelines
☐ uses personal initiative to formulate questions and find answers
☐ plans and uses time effectively

Information Gathering and Processing

☐ accesses a range of relevant in-school/community resources
☐ uses a range of information-gathering techniques
☐ interprets, organizes and combines information into a logical sequence
☐ records information accurately with appropriate supporting detail and using correct technical terms
☐ determines accuracy/currency/reliability of information sources
☐ gathers and responds to feedback regarding approach to the task

Content

☐ identifies basic raw materials/feedstocks used within an oil, gas, oil sands or coal processing/refining/ upgrading industry
☐ identifies other inputs to processing/refining/ upgrading within the oil, gas, oil sands or coal industry; e.g.:
  - financial
  - human
  - energy
  - technological

Content (continued)

☐ identifies economic factors that influence the nature of the processing/refining/upgrading industry; e.g.:
  - supply/cost of feedstocks and other inputs
  - allowable production volumes
  - access to markets

☐ explains how the mix of products produced may need to vary according to market demand; e.g.:
  - summer
  - winter

☐ identifies personal and environmental safety factors that influence practices within the industry; e.g.:
  - safety of workers and nearby residents
  - impact on crops, forests, livestock and wildlife
  - air, soil and water quality factors

☐ ____________________
____

Collaboration and Teamwork

☐ cooperates with group members
☐ shares work appropriately among group members
☐ negotiates solutions to problems

Information Sharing

☐ demonstrates effective use of two or more communication media:
e.g., written, oral, audio-visual
☐ communicates ideas in a logical sequence with sufficient supporting detail
☐ maintains acceptable grammatical and technical standards
☐ cites five or more relevant information sources

REFLECTIONS/COMMENTS

RESEARCH PROCESS: Mineral Processing ENM2070–1

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering and Processing	4	3	2	1	0	N/A
Content	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A

STANDARD IS 2 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

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1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

- ☐ sets goals and establishes steps to achieve them
- ☐ creates and adheres to useful timelines
- ☐ uses personal initiative to formulate questions and find answers
- ☐ plans and uses time effectively

Information Gathering and Processing

- ☐ accesses a range of relevant in-school/community resources
- ☐ uses a range of information-gathering techniques
- ☐ interprets, organizes and combines information into a logical sequence
- ☐ records information accurately with appropriate supporting detail and using correct technical terms
- ☐ determines accuracy/currency/reliability of information sources
- ☐ gathers and responds to feedback regarding approach to the task

Content

- ☐ identifies basic raw materials used within a mineral processing/upgrading industry; e.g.:
  - – mineral ores
  - – aggregates
- ☐ identifies other inputs to processing/upgrading within the industry; e.g.:
  - – financial
  - – human
  - – energy
  - – technological

Content (continued)

- ☐ identifies economic factors that influence the nature of the mineral processing/upgrading industry; e.g.:
  - – supply/cost of raw materials and other inputs
  - – allowable production volumes
  - – access to markets
- ☐ explains how the mix of products produced may need to vary according to market demand; e.g.:
  - – seasonal adjustments
  - – economic trends
- ☐ identifies personal and environmental safety factors that influence practices within the industry; e.g.:
  - – safety of workers and nearby residents
  - – impact on crops, forests, livestock and wildlife
  - – air, soil and water quality factors
- ☐ ________________________________
  ____

Collaboration and Teamwork

- ☐ cooperates with group members
- ☐ shares work appropriately among group members
- ☐ negotiates solutions to problems

Information Sharing

- ☐ demonstrates effective use of two or more communication media:
  e.g., written, oral, audio-visual
- ☐ communicates ideas in a logical sequence with sufficient supporting detail
- ☐ maintains acceptable grammatical and technical standards
- ☐ cites five or more relevant information sources

REFLECTIONS/COMMENTS

RESEARCH PROCESS: Environmental Policies and Guidelines ENM2100–1

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering and Processing	4	3	2	1	0	N/A
Content	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A

STANDARD IS 2 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ sets goals and establishes steps to achieve them
☐ creates and adheres to useful timelines
☐ uses personal initiative to formulate questions and find answers
☐ plans and uses time effectively

Information Gathering and Processing

☐ accesses a range of relevant in-school/community resources
☐ uses a range of information-gathering techniques
☐ interprets, organizes and combines information into a logical sequence
☐ records information accurately with appropriate supporting detail and using correct technical terms
☐ determines accuracy/currency/reliability of information sources
☐ gathers and responds to feedback regarding approach to the task

Content

☐ explains how industry and government work together in developing environmental monitoring and management practices
☐ describes general goals of the *Federal Green Plan*
☐ identifies provincial and federal legislation regarding protection of the environment; e.g.:
  – *Clean Air Act*
  – *Clean Water Act*
  – *Environmental Protection and Enhancement Act*
☐ explains strategies for and local examples of public involvement in environmental decision making; e.g.:
  – Friends of the Oldman River Association
  – Alberta Wilderness Society

Content (continued)

☐ identifies specific legislation relating to operations within an energy or mineral industry; e.g.:
  – exploration
  – recovery/production
  – processing/refining
  – distribution
☐ describes construction and/or operating approvals required for one or more operations within an energy or mineral industry
☐ proposes changes to existing policy and/or new legislation regarding an environmental concern within an energy or mineral industry; e.g.:
  – sulphur dioxide/carbon dioxide emissions
  – water treatment
  – toxic waste management
☐ ______________________________
____

Collaboration and Teamwork

☐ cooperates with group members
☐ shares work appropriately among group members
☐ negotiates solutions to problems

Information Sharing

☐ demonstrates effective use of two or more communication media:
e.g., written, oral, audio-visual
☐ communicates ideas in a logical sequence with sufficient supporting detail
☐ maintains acceptable grammatical and technical standards
☐ cites five or more relevant information sources

TASK CHECKLIST: Conducting an Energy Use Audit

ENM3010–1

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering	4	3	2	1	0	N/A
Communicating Goals	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A

STANDARD IS 3 FOR EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ demonstrates an awareness of the importance of energy conservation
☐ sets goals and establishes steps to achieve them
☐ creates and follows useful timelines
☐ plans and uses time effectively

Information Gathering: Residential/Commercial Environments

☐ accesses information relevant to conducting an energy inventory; e.g.:
  - utility costs for 12 consecutive months
  - hours of operation/occupancy
  - size of structure
  - type of construction (e.g., windows, doors)
  - efficiency ratings of existing equipment/ appliances
☐ identifies potential areas for reducing energy use
☐ assesses the costs/benefits of maintaining current rates of energy use, and of upgrading the existing facilities/equipment to reduce energy use; e.g.:
  - economic
  - social
  - environmental
☐ establishes a target level of energy efficiency
☐ ______________________________
____

Information Gathering: Transportation Sector

☐ accesses information relevant to conducting an energy inventory; e.g.:
  - people involved in maintenance and use
  - maintenance and operating costs for 12 consecutive months
  - vehicle selection for fuel economy
  - policies/practices to ensure driving conducive to fuel efficiency

Information Gathering: Transportation Sector (continued)

☐ identifies potential areas for reducing fuel consumption
☐ assesses the costs/benefits of maintaining current rates of fuel consumption, and of upgrading the existing vehicles to reduce energy use; e.g.:
  - economic
  - social
  - environmental
☐ establishes a target level of energy efficiency
☐ ______________________________
____

Communicating Goals

☐ presents information to home/school/community in a logical sequence using appropriate format
☐ clearly states a policy regarding energy use and outlines energy conservation objectives
☐ outlines a plan of action for achieving energy-use goals
☐ solicits support of key stakeholder groups in implementing the plan of action
☐ ______________________________
____

Collaboration and Teamwork

☐ shares work and responsibilities among group members
☐ shares information and ideas through group discussion
☐ respects the views of others
☐ negotiates solutions to problems
☐ demonstrates desire to develop consensus
☐ ______________________________
____

GUIDE TO INFERENCES: Personal Impact on Resources ENM3010–2

INFERENCE

Definition: to derive a conclusion from facts or premises

Synonyms: infer, deduce, deduct, draw, gather , judge

Criteria for Assessing Inferences

Inferences made in advanced level modules should:

- communicate the process used to derive conclusions
- be reliable and valid in light of information gathered.

Inferences must be communicated in a logical sequence with sufficient supporting detail. Both the type and the amount of information used to derive a conclusion are important in determining the reliability/validity of the inference.

Each inference made regarding potential impacts of lifestyle practices on energy resources should provide:

- a clear statement of the factors being investigated
- relevant facts and detail that support more than one point of view;
  e.g., cultural, ethical, economic, environmental, health-related, scientific, political
- a logical sequence of ideas that lead to a conclusion
- evidence that different points of view were considered in deriving the conclusion
- a valid and realistic conclusion that is based on analysis and synthesis of information

Journal of Lifestyle Practices

The journal will include 10 or more entries that describe lifestyle practices that affect an energy resource. Activities may be seasonal in nature, yet need to be of sufficient duration to permit reflection on their consequences. Each journal entry should describe:

☐ the nature of the activity
☐ a rationale for participating in the activity
☐ inferences regarding both short- and long-term consequences for the resource and the environment.

Journal entries may reference activities that:

- involve direct consumption of energy resources
- influence energy resources in indirect ways.

Suggested Reference: *A Primer on Environmental Citizenship*, Environment Canada

STANDARD: Complete 10 journal entries that address criteria for inferences to a standard of 3 on the rating scale.

Rating Scale

The student:

4	3	2	1	0
exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.	meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.	meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.	meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.	has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

TASK CHECKLIST: Conducting a Cost-Benefit Analysis ENM3010–3

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering	4	3	2	1	0	N/A
Evaluating Choices/Making Decisions	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A

STANDARD IS 3 FOR EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

- ☐ demonstrates an awareness of the importance of energy conservation
- ☐ sets goals and establishes steps to achieve them
- ☐ creates and follows useful timelines
- ☐ plans and uses time effectively

Information Gathering

- ☐ accesses information relevant to conducting a cost-benefit analysis of an energy-saving technology
- ☐ identifies the costs of using the energy-saving technology; e.g.:
  - economic
  - social
  - environmental
- ☐ identifies the benefits of using the energy-saving technology; e.g.:
  - economic
  - social
  - environmental
- ☐ ____________________

Evaluating Choices/Making Decisions

- ☐ assesses the costs and benefits of using the energy-saving technology
- ☐ establishes a target level of energy efficiency and use
- ☐ outlines a plan of action for achieving energy-use goals
- ☐ solicits the support of key stakeholder groups in achieving energy-use goals
- ☐ states conclusions regarding personal use of the energy-saving technology
- ☐ communicates results of the analysis in a logical sequence using appropriate format
- ☐ ____________________

Collaboration and Teamwork

- ☐ shares work and responsibilities among group members
- ☐ shares information and ideas through group discussion
- ☐ respects the views of others
- ☐ negotiates solutions to problems
- ☐ demonstrates desire to develop consensus
- ☐ ____________________

REFLECTIONS/COMMENTS

RESEARCH PROCESS: Enhanced Oil Recovery ENM3020-1

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering and Processing	4	3	2	1	0	N/A
Content	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A

STANDARD IS 3 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ sets clear goals and establishes steps to achieve them
☐ creates and adheres to detailed timelines
☐ uses personal initiative to formulate questions and find answers
☐ plans and uses time effectively, prioritizing tasks on a consistent basis

Information Gathering and Processing

☐ accesses a range of relevant information sources and recognizes when additional information is required
☐ demonstrates resourcefulness in collecting data
☐ interprets, organizes and combines information in creative and thoughtful ways
☐ records information accurately with appropriate supporting detail and using correct technical terms
☐ recognizes underlying bias/assumptions/values in information sources
☐ assesses and refines approach to the task and project status based on feedback and reflection

Content

☐ identifies factors that determine the portion of oil in a reservoir that can be produced naturally through primary recovery methods; e.g.:
  – density and viscosity of the oil
  – porosity and permeability of the rock
  – pressure in the reservoir
☐ explains applications of infill drilling and directional wells to improve oil or gas recovery rates
☐ explains secondary methods of enhanced oil recovery:
  – water and gas injection
  – pumping technology

Content (continued)

☐ explains tertiary methods of enhanced oil recovery:
  – miscible flooding
  – steam injection
  – fireflooding
  – horizontal drilling
☐ identifies factors that influence the life of an oil and/or gas well
☐ describes techniques used to estimate recoverable oil and gas reserves; e.g.:
  – "proved reserves"
  – "probable reserves"
  – "established reserves"
☐ makes forecasts regarding the future development of oil and gas reserves; e.g.:
  – improved recovery from existing reservoirs
  – frontier production
  – oil sands
☐ ____________________
____

Collaboration and Teamwork

☐ cooperates with group members
☐ shares work appropriately among group members
☐ negotiates solutions to problems
☐ displays effective communication and leadership skills

Information Sharing

☐ demonstrates effective use of a variety of communication media:
e.g., written, oral, audio-visual
☐ communicates thoughts/feelings/ideas clearly to justify or challenge a position
☐ maintains acceptable grammatical and technical standards
☐ gives evidence of adequate information gathering by citing seven or more relevant information sources

RESEARCH PROCESS: Enhanced Recovery of Nonconventional Hydrocarbons ENM3030-1

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering and Processing	4	3	2	1	0	N/A
Content	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A

STANDARD IS 3 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ sets clear goals and establishes steps to achieve them
☐ creates and adheres to detailed timelines
☐ uses personal initiative to formulate questions and find answers
☐ plans and uses time effectively, prioritizing tasks on a consistent basis

Information Gathering and Processing

☐ accesses a range of relevant information sources and recognizes when additional information is required
☐ demonstrates resourcefulness in collecting data
☐ interprets, organizes and combines information in creative and thoughtful ways
☐ records information accurately with appropriate supporting detail and using correct technical terms
☐ recognizes underlying bias/assumptions/values in information sources
☐ assesses and refines approach to the task and project status based on feedback and reflection

Content

☐ identifies factors that affect the recovery potential for heavy oil, oil sands or coal deposits; e.g.:
  - nature and depth of overburden
  - density and viscosity of oil
  - porosity and permeability of rock structures
  - economic viability

☐ explains technologies used to maximize recovery of nonconventional hydrocarbon resources:
  - horizontal drilling
  - extraction and separation processes

Content (continued)

☐ explains special drilling techniques, core description and/or geophysical logging used in developing a nonconventional hydrocarbon resource
☐ identifies public and private agencies currently involved in developing new technology to assist in the recovery of nonconventional hydrocarbon resources; e.g.:
  - Alberta Research Council
  - Alberta Oil Sands Technology and Research Authority
  - Office of Coal Research and Technology

☐ describes techniques used to estimate Alberta's recoverable heavy oil, bitumen and coal; e.g.:
  - "proved reserves"
  - "probable reserves"
  - "established reserves"

☐ ______________________________
____

Collaboration and Teamwork

☐ cooperates with group members
☐ shares work appropriately among group members
☐ negotiates solutions to problems
☐ displays effective communication and leadership skills

Information Sharing

☐ demonstrates effective use of a variety of communication media:
e.g., written, oral, audio-visual
☐ communicates thoughts/feelings/ideas clearly to justify or challenge a position
☐ maintains acceptable grammatical and technical standards
☐ gives evidence of adequate information gathering by citing seven or more relevant information sources

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RESEARCH PROCESS: Enhanced Mineral Recovery ENM3040–1

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering and Processing	4	3	2	1	0	N/A
Content	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A

STANDARD IS 3 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning
☐ sets clear goals and establishes steps to achieve them
☐ creates and adheres to detailed timelines
☐ uses personal initiative to formulate questions and find answers
☐ plans and uses time effectively, prioritizing tasks on a consistent basis

Information Gathering and Processing
☐ accesses a range of relevant information sources and recognizes when additional information is required
☐ demonstrates resourcefulness in collecting data
☐ interprets, organizes and combines information in creative and thoughtful ways
☐ records information accurately with appropriate supporting detail and using correct technical terms
☐ recognizes underlying bias/assumptions/values in information sources
☐ assesses and refines approach to the task and project status based on feedback and reflection

Content
☐ identifies factors that affect the recovery potential for a mineral deposit; e.g.:
  - depth of overburden
  - size and nature of deposit
  - porosity and permeability of rock structures
  - economic viability
  - environmental impact

☐ explains technologies used to enhance recovery of economic mineral deposits:
  - drilling and blasting techniques
  - rock bolting and screening machines
  - video technology and remote control
  - innovations in separation technology

Content (continued)
☐ identifies methods used for the exploration of "hidden" or "blind" deposits
☐ identifies public and private agencies currently involved in developing new technology to assist in the recovery of economic mineral deposits; e.g.:
  - Alberta Research Council
  - National Research Council

☐ describes techniques used to estimate recoverable mineral deposits in Alberta; e.g.:
  - computing techniques
  - assays
  - mathematical modelling

☐ ______________________________
____
☐ ______________________________
____

Collaboration and Teamwork
☐ cooperates with group members
☐ shares work appropriately among group members
☐ negotiates solutions to problems
☐ displays effective communication and leadership skills

Information Sharing
☐ demonstrates effective use of a variety of communication media:
e.g., written, oral, audio-visual
☐ communicates thoughts/feelings/ideas clearly to justify or challenge a position
☐ maintains acceptable grammatical and technical standards
☐ gives evidence of adequate information gathering by citing seven or more relevant information sources

ISSUE ANALYSIS: Energy Supply and Demand ENM3050–1

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Analyzing Perspectives	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Evaluating Choices/Making Decisions	4	3	2	1	0	N/A

STANDARD IS 3 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ accurately describes two issues on which people disagree regarding energy supply and demand at local and global levels

☐ poses thoughtful questions regarding specific causes of disagreement on each of the issues

☐ accesses a range of relevant information sources regarding each of the issues, and recognizes when additional information is required

☐ demonstrates resourcefulness in collecting data

Analyzing Perspectives

☐ clarifies different points of view regarding each of the issues:
e.g., cultural, ethical, economic, environmental, health-related, scientific, political

☐ states a position on each of the issues and insightful reasons for adopting that position

☐ states three or more opposing positions on each issue and thoughtful reasons for adopting each position

☐ analyzes interrelationships among different perspectives/points of view

☐ recognizes underlying bias/assumptions/values in information and ideas

Collaboration and Tramwork

☐ shares information and ideas appropriately among group members

☐ respects and considers the views of others

☐ negotiates with sensitivity solutions to problems

Evaluating Choices/Making Decisions

☐ describes in detail important and appropriate alternatives regarding energy supply and demand

☐ establishes knowledge- and value-based criteria for assessing each alternative:
e.g., social, economic, environmental

☐ ____________________

☐ selects appropriate and useful alternatives regarding energy supply/demand by showing differences among choices

☐ assesses strengths/weaknesses of decisions by considering consequences and implications; e.g.:
  - sustainable development
  - other quality of life factors

☐ ____________________

☐ communicates thoughts/feelings/ideas clearly to justify choices/decisions made

☐ ____________________

REFLECTIONS/COMMENTS

RESEARCH PROCESS: Sustainable Energy Development ENM3050–2

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering and Processing	4	3	2	1	0	N/A
Content	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A

STANDARD IS 3 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ sets clear goals and establishes steps to achieve them
☐ creates and adheres to detailed timelines
☐ uses personal initiative to formulate questions and find answers
☐ plans and uses time effectively, prioritizing tasks on a consistent basis

Information Gathering and Processing

☐ accesses a range of relevant information sources and recognizes when additional information is required
☐ demonstrates resourcefulness in collecting data
☐ interprets, organizes and combines information in creative and thoughtful ways
☐ records information accurately with appropriate supporting detail and using correct technical terms
☐ recognizes underlying bias/assumptions/values in information sources
☐ assesses and refines approach to the task and project status based on feedback and reflection

Content

☐ identifies social, economic and environmental concerns regarding conventional energy supply; e.g.:
  - how much?
  - how fast?

☐ suggests a rationale for sustainable energy development that addresses social, economic and environmental concerns
☐ considers benefits and obstacles to the use of renewable and nonrenewable technology in sustainable energy development
☐ makes forecasts regarding future energy supply and demand, and identifies options for ensuring a sustainable energy future; e.g.:
  - using less
  - finding alternative sources

Content (continued)

☐ cites examples of sustainable energy path development that involve least-cost combinations and efficient use of both renewable and nonrenewable energy sources; e.g.:
  - energy conservation/efficiency and "conservation lifestyles"
  - saving conventional sources for their "ideal" use, and supplementing where possible with renewable technology

☐ proposes changes to current social values and political structures that will support sustainable energy development; e.g.:
  - consumer preferences/practices
  - legislative policies and guidelines
  - support for research and development of new technology

☐ ______________________________
____

Collaboration and Teamwork

☐ cooperates with group members
☐ shares work appropriately among group members
☐ negotiates solutions to problems
☐ displays effective communication and leadership skills

Information Sharing

☐ demonstrates effective use of a variety of communication media:
e.g., written, oral, audio-visual
☐ communicates thoughts/feelings/ideas clearly to justify or challenge a position
☐ maintains acceptable grammatical and technical standards
☐ gives evidence of adequate information gathering by citing seven or more relevant information sources

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ASSESSMENT CRITERIA: Energy Management Campaign ENM3050–3

RATING	ASSESSMENT CRITERIA
	The student:
4 3 2 1 0	**Planning the Campaign** ☐ defines the task ☐ outlines conservation and efficiency measures that can be implemented ☐ sets goals and establishes steps to achieve them ☐ creates and adheres to useful timelines ☐ clearly states a plan of action ☐ plans and uses time effectively ☐ ______ ☐ ______
4 3 2 1 0	**Implementing the Campaign** ☐ develops promotional materials; e.g.: – posters and handbills – videotaped commercials – information programs ☐ acquires necessary permission to promote and display campaign materials ☐ assumes and/or delegates responsibilities ☐ presents and promotes the campaign to members of the school and community ☐ demonstrates personal initiative in implementing the plan of action ☐ ______ ☐ ______
4 3 2 1 0	**Assessing the Campaign** ☐ monitors and assesses the campaign ☐ modifies responsibilities/actions as required to achieve goals ☐ makes summative statements regarding strengths/weaknesses and general feasibility of the plan for demand-side energy management ☐ ______ ☐ ______
4 3 2 1 0	**Collaboration and Teamwork** ☐ works with a range of peer members ☐ shares work and responsibilities among group members ☐ shares information and ideas through group discussions ☐ negotiates solutions to problems ☐ ______ ☐ ______

STANDARD IS 3 IN EACH APPLICABLE TASK

Rating Scale

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

N/A Not Applicable

REFLECTIONS/COMMENTS

RESEARCH PROCESS: Petrochemical Processing ENM3060–1

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering and Processing	4	3	2	1	0	N/A
Content	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A

STANDARD IS 3 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ sets clear goals and establishes steps to achieve them
☐ creates and adheres to detailed timelines
☐ uses personal initiative to formulate questions and find answers
☐ plans and uses time effectively, prioritizing tasks on a consistent basis

Information Gathering and Processing

☐ accesses a range of relevant information sources and recognizes when additional information is required
☐ demonstrates resourcefulness in collecting data
☐ interprets, organizes and combines information in creative and thoughtful ways
☐ records information accurately with appropriate supporting detail and using correct technical terms
☐ recognizes underlying bias/assumptions/values in information sources
☐ assesses and refines approach to the task and project status based on feedback and reflection

Content

☐ identifies and describes important petroleum feedstocks used in the petrochemical industry
☐ describes techniques used to sort, break apart, reassemble and/or blend petroleum molecules; e.g.:
  - fractionating
  - cracking
  - polymerization
  - isomerization

Content (continued)

☐ explains the role of temperature, pressure and catalysts in sorting and rearranging petroleum molecules
☐ explains applications of electronic equipment and computer technology in monitoring and controlling petrochemical processing
☐ identifies and describes intermediate and finished products that are derived from petrochemicals through processes of cracking, polymerization and isomerization
☐ ______________________________

Collaboration and Teamwork

☐ cooperates with group members
☐ shares work appropriately among group members
☐ negotiates solutions to problems
☐ displays effective communication and leadership skills

Information Sharing

☐ demonstrates effective use of a variety of communication media:
e.g., written, oral, audio-visual
☐ communicates thoughts/feelings/ideas clearly to justify or challenge a position
☐ maintains acceptable grammatical and technical standards
☐ gives evidence of adequate information gathering by citing seven or more relevant information sources

REFLECTIONS/COMMENTS

RESEARCH PROCESS: Industrial (Stock) Materials ENM3070–1

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering and Processing	4	3	2	1	0	N/A
Content	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A

STANDARD IS 3 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ sets clear goals and establishes steps to achieve them
☐ creates and adheres to detailed timelines
☐ uses personal initiative to formulate questions and find answers
☐ plans and uses time effectively, prioritizing tasks on a consistent basis

Information Gathering and Processing

☐ accesses a range of relevant information sources and recognizes when additional information is required
☐ demonstrates resourcefulness in collecting data
☐ interprets, organizes and combines information in creative and thoughtful ways
☐ records information accurately with appropriate supporting detail and using correct technical terms
☐ recognizes underlying bias/assumptions/values in information sources
☐ assesses and refines approach to the task and project status based on feedback and reflection

Content

☐ identifies and compares primary and secondary manufacturing processes
☐ describes major categories of raw materials used in primary manufacturing; e.g.:
  - petroleum
  - natural gas
  - metallic ores
  - nonmetallic ores

Content (continued)

☐ identifies and describes major types of industrial (stock) materials produced through primary manufacturing processes; e.g.:
  - metallic
  - structural
  - polymeric
  - ceramic
  - composite

☐ describes standard forms for each type of industrial (stock) material; e.g.:
  - plate, bar and rod
  - sheet, roll and film
  - pellet and powder

Collaboration and Teamwork

☐ cooperates with group members
☐ shares work appropriately among group members
☐ negotiates solutions to problems
☐ displays effective communication and leadership skills

Information Sharing

☐ demonstrates effective use of a variety of communication media:
e.g., written, oral, audio-visual
☐ communicates thoughts/feelings/ideas clearly to justify or challenge a position
☐ maintains acceptable grammatical and technical standards
☐ gives evidence of adequate information gathering by citing seven or more relevant information sources

REFLECTIONS/COMMENTS

ASSESSMENT CRITERIA: Components of a Marketing Strategy ENM3080–1

RATING	ASSESSMENT CRITERIA
4 3 2 1 0	*The student:* **Scheduling Tasks** ☐ defines the task ☐ identifies task components and organizes them into a logical sequence ☐ uses time effectively ☐ ________________
4 3 2 1 0	**Identifying Marketing Components** ☐ accesses basic in-school/community information sources regarding the product/service and potential customers/markets ☐ describes the product/service, customer and target market ☐ assesses commodity supply and/or suitability of product/service suppliers ☐ identifies existing sources of competition within the marketplace ☐ describes marketing alternatives for the product/service; e.g.: – nonregulated (open) – regulated (closed) ☐ explains how products are moved to market, including the function of intermediate stops ☐ describes the pricing strategy based on market analysis, supply/demand and cost factors ☐ describes the advertising and promotion strategy ☐ identifies intended marketing outcomes and/or product/service sales ☐ summarizes opportunities and challenges relevant to the marketing plan ☐ ________________
4 3 2 1 0	**Assessing and Communicating the Marketing Strategy** ☐ presents the marketing strategy in a logical sequence using one or more communication media ☐ uses correct grammar and technical terms ☐ assesses the current and potential achievement of marketing goals ☐ make summative statements regarding strengths/weaknesses and general success of the marketing plan ☐ ________________

STANDARD IS 3 IN EACH APPLICABLE TASK

Rating Scale

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

N/A Not Applicable

REFLECTIONS/COMMENTS

ASSESSMENT CRITERIA: Developing a Marketing Plan ENM3080-2

RATING	ASSESSMENT CRITERIA
	The student:
4 3 2 1 0	**Scheduling Tasks** ☐ defines the task ☐ sets goals and establishes steps to achieve them ☐ plans and uses time effectively ☐ ____________________
4 3 2 1 0	**Gathering Relevant Information** ☐ poses important questions regarding a new (or altered) policy, product and/or service ☐ accesses a range of relevant in-school/community resources ☐ determines accuracy/currency/reliability of information sources ☐ ____________________
4 3 2 1 0	**Developing the Plan** ☐ identifies potential market opportunities arising from: – product diversification/specialization – international trade ☐ conducts a survey of consumer preferences and market opportunities ☐ assesses relevant social, economic and environmental factors that may affect marketing plans ☐ defines the policy, product and/or service and target market(s) ☐ establishes viable strategies for developing the policy, product and/or service ☐ identifies trade structures, policies and/or other agreements that will be required to support the marketing plan ☐ summarizes opportunities and challenges relevant to the policy, product and/or markets ☐ ____________________
4 3 2 1 0	**Presenting and Assessing the Plan** ☐ presents the plan in a logical sequence using two or more communication media: – market conditions that led to product development – steps involved in policy/product development – recommended marketing alternatives and promotional strategies ☐ uses correct grammatical convention and technical terms ☐ makes summative statements regarding strengths/weaknesses and general feasibility of the plan for policy, product and/or market development ☐ ____________________

STANDARD IS 3 IN EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

N/A Not Applicable

REFLECTIONS/COMMENTS

TASK CHECKLIST: Energy Audit ENM3090–1

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering	4	3	2	1	0	N/A
Communicating Goals	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A

STANDARD IS 3 FOR EACH APPLICABLE TASK

Rating Scale

The student:

4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.

3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.

2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.

1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.

0 has not completed defined outcomes. Tools, materials and/or processes are used in appropriately.

N/A Not applicable

TASK CHECKLIST

The student:

Preparation and Planning

☐ demonstrates an awareness of the importance of energy conservation

☐ sets goals and establishes steps to achieve them

☐ creates and follows useful timelines

☐ plans and uses time effectively

Information Gathering: Residential/Commercial Environments

☐ accesses information relevant to conducting an energy inventory; e.g.:
  - utility costs for 12 consecutive months
  - hours of operation/occupancy
  - size of structure
  - type of construction (e.g., windows, doors)
  - efficiency ratings of existing equipment/ appliances

☐ identifies potential areas for reducing energy use

☐ assesses the economic, social and environmental costs/benefits of:
  - maintaining current rates of energy use
  - upgrading existing facilities/equipment to reduce energy use

☐ establishes a target level of energy efficiency

☐ ______________________________
____

Information Gathering: Transportation Sector

☐ accesses information relevant to conducting an energy inventory; e.g.:
  - people involved in maintenance and use
  - maintenance and operating costs for 12 consecutive months
  - vehicle selection for fuel economy
  - policies/practices to ensure driving conducive to fuel efficiency

Information Gathering: Transportation Sector (continued)

☐ identifies potential areas for reducing fuel consumption

☐ assesses the economic, social and environmental costs/benefits of:
  - maintaining current rates of fuel consumption
  - upgrading the existing systems to reduce energy use

☐ establishes a target level of energy efficiency

☐ ______________________________
____

Communicating Goals

☐ presents information to home/school/community in a logical sequence using appropriate format

☐ clearly states a policy regarding energy use and energy conservation objectives

☐ outlines a plan of action for achieving energy-use goals

☐ solicits support of key stakeholder groups in implementing the plan of action

☐ ______________________________
____

Collaboration and Teamwork

☐ shares work and responsibilities among group members

☐ shares information and ideas through group discussion

☐ respects the views of others

☐ negotiates solutions to problems

☐ works toward developing consensus

☐ ______________________________
____

ASSESSMENT CRITERIA: Developing a Resource Management Plan ENM3100–1

MANAGEMENT OUTCOMES

The student:

- ☐ identifies short- and long-term management goals for the use of an energy or mineral resource based on one type of need (e.g., residential)
- ☐ justifies management goals as the preferred alternative for resource use
- ☐ proposes a management plan for the resource consistent with management goals that includes:
  - a statement of government policies and guidelines
  - a schedule of management activities
  - a process for public involvement
  - a strategy for monitoring use and resolving potential conflicts
- ☐ presents the management plan to class/peers in a logical sequence, supporting points with sound evidence
- ☐ identifies significant features of management plans presented by class/peers for the same resource based on other needs (e.g., commercial, industrial, transportation)
- ☐ negotiates with class/peers a set of compromised management goals and strategies that support integrated resource use based on social, economic and environmental factors
- ☐ presents an integrated management plan for the resource consistent with compromised management goals and strategies which attempts to address:
  - the views of relevant stakeholder groups
  - short- and long-term goals and objectives
  - proposed management standards and guidelines
  - a process for public involvement
  - a strategy for monitoring use and resolving potential conflicts

PLANNING PROCESSES

Planning and Preparation

- ☐ sets goals and establishes steps to achieve them
- ☐ creates and adheres to useful timelines
- ☐ uses personal initiative to formulate questions and find answers
- ☐ plans and uses time effectively

Information Gathering and Processing

- ☐ accesses a variety of relevant information sources
- ☐ interprets, organizes and combines information in effective ways
- ☐ uses appropriate methods to calculate data and obtain accurate results

Collaboration and Teamwork

- ☐ cooperates with and shares work appropriately among team members
- ☐ shares information/opinions/suggestions, maintaining a balance between speaking and listening
- ☐ considers the ideas and suggestions of others, and when appropriate integrates new ideas into personal frame of reference

Negotiating and Debating

- ☐ explains positions adopted by presenting examples of possible consequences and implications
- ☐ presents a realistic plan in logical sequence supporting positions adopted
- ☐ provides a relevant and convincing rebuttal to opposing views
- ☐ negotiates solutions to problems and shared agreements by resolving divergent points of view

RATING SCALE

The student:

4	3	2	1	0
exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.	meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.	meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.	meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.	has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

STANDARD IS 2 IN MANAGEMENT OUTCOMES AND 3 IN PLANNING PROCESSES

ENERGY & MINES

SECTION H: LINKAGES/TRANSITIONS

This section of the Guide has been designed to provide an overview of linkages and transitions of CTS modules with a number of organizations. The charts and information presented in this section will assist CTS students and teachers in understanding the potential application of CTS modules as students move into the workplace.

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LINKAGES/TRANSITIONS

LINKAGES

With Other CTS Strands

The Energy and Mines strand provides opportunities for students to develop competencies in one or more sectors of an energy or mineral industry, including:

- exploration
- recovery and production
- refining and manufacturing
- marketing
- energy design and conservation
- environmental management.

Each industry sector (and area of course emphasis) links with competencies that are developed in other CTS strands. To facilitate and strengthen these linkages, CTS courses may be designed by combining Energy and Mines modules with modules from other CTS strands (e.g., Agriculture, Career Transitions, Community Health, Design Studies, Electro-Technologies, Fabrication Studies, Forestry, Legal Studies, Management and Marketing, Mechanics and Wildlife).

Linkages of particular relevance to the design of CTS courses in Energy and Mines include:

Strand	Themes and/or Modules
Career Transitions	**Project modules** provide opportunities for learning beyond the expectations of given Energy and Mines modules. **Practicum modules** enable students to work toward obtaining credentials recognized in the workplace/ community. **Safety modules** provide opportunities to address safety skills relevant to specific sectors of an energy or mineral industry.
Community Health	Modules within the "Injury Prevention" theme link with a range of workplace competencies developed within the Energy and Mines strand.
Design Studies	Design principles and technical drawing skills have a range of applications in the design/construction of energy systems.
Electro-Technologies	Modules within the "Power Systems" and "Computer Logic" themes have application in industry-based exploration, recovery, production and refining operations (e.g., maintenance and use of electrical systems).
Legal Studies	Modules within the "Societal Contexts" theme (e.g., Environmental Law, Dispute Resolution, Landmark Decisions) can be contextualized within an energy or mineral industry.
Mechanics	Modules within the "Propulsion Systems" and "Guidance and Control Systems" themes have application in industry-based exploration, recovery, production and refining operations (e.g., maintenance and use of power driven machines).

It is important to note that the project, practicum and safety modules in Career Transitions may be combined with Energy and Mines modules to provide opportunities for students to:

- acquire safety competencies and credentials
- develop specific workplace skills
- expand upon a topic in a module or theme
- complete a design and/or construction project.

Additional information regarding connections with other CTS strands is provided in "Connections with Other CTS Strands."

Sample courses in Energy and Mines that include modules from other CTS strands are provided in "Energy and Mines in Junior High" and "Energy and Mines in Senior High."

With Other Secondary Programs

The Energy and Mines strand has many links with other core and complementary subject areas across the curriculum. For example, many of the modules in Energy and Mines link with the junior and senior high science programs, and provide opportunities for students to extend and apply related knowledge and skills in practical ways.

Core and complementary course linkages of particular relevance to CTS courses in Energy and Mines include:

Course/ Program Area	Linkage/Connection
Language Arts	Application of the research process; development of reporting and oral/ multimedia presentation skills within a range of industry contexts.
Mathematics	Application of number operations, variables and equations, measurement, data analysis, chance and uncertainty within a range of industry contexts (e.g., exploration, recovery and production, refining, energy design).
Science	Use of observation and experimentation; knowledge and theory of relevant topics in earth science, chemistry and physics; analysis of relationships among science, technology, society and the environment.
Social Studies	Knowledge of the impact of social, economic and environmental perspectives on energy/mineral development; issue analysis, negotiation, debate and environmental citizenship within a range of industry contexts.
CALM	Awareness of career opportunities and trends; career research and preparation.

Additional information regarding connections between Energy and Mines modules and other core and complementary subject areas is provided in "Energy & Mines: Connections Across the Curriculum."

TRANSITIONS

To the Workplace

Intermediate and advanced modules are designed to develop knowledge, skills and attitudes that provide transitions to occupations in Alberta's energy and mineral industries. Some career sectors welcome individuals who have basic skills and are prepared to learn through further training from the employer.

The National Occupational Classification (NOC) chart in this section indicates occupations for which the Energy and Mines strand provides a foundation (see "Energy & Mines: Related Occupations").

To Related Post-secondary Programs

Advanced level modules will assist students to make plans regarding further studies in related programs at post-secondary levels. These modules provide desirable background and skills for entry into related industrial and environmental programs at public and private colleges, technical institutes, universities and vocational colleges in Alberta.

A summary of industry-related programs currently offered at post-secondary institutions in Alberta is provided in Energy & Mines: Summary of Related Post-Secondary Programs.

A number of articulation agreements have been established with post-secondary institutions in Alberta. These agreements provide preferred entrance and/or advanced standing/credit for CTS students who have successfully completed designated modules. A summary of articulation agreements in place that involve CTS modules is available through Alberta Education's web site at

<http://ednet.edc.gov.ab.ca>. For further information regarding particular articulation agreements, contact the post-secondary institution and/or review its calendar.

Of particular relevance to courses in Energy and Mines is the Southern Alberta Institute of Technology (SAIT) Open Learning Instructional System. Developed by its Energy and Natural Resources Department, and referred to as SOLIS, the program offers an extensive range of modularized learning packages that provide training in:

- occupational health and safety
- industrial environmental awareness
- power engineering technology.

SOLIS modules can be used in traditional classroom settings or for distance learning, and provide an effective way to meet the needs of individual students. In addition to developing competencies that are consistent with standards established by the oil, gas and petrochemical industries, students who successfully complete one or more SOLIS modules will be given advanced credit in programs that use these modules at SAIT.

CREDENTIALLING

Students may earn partial or complete credentials recognized in the workplace and/or post-secondary institutions by demonstrating specified competencies within the CTS curriculum. The Energy and Mines strand, in conjunction with modules from the Career Transitions strand, provides opportunities for students to develop competencies that link with a number of credentialling programs.

Of particular significance are credentials available through:

- First Aid certificate courses
- Petroleum Industry Training Service (PITS) programs
- provincially and federally established occupational health and safety programs.

Teachers may wish to explore opportunities for linking courses in Energy and Mines with these and/or other credentialling programs. A partial list of credentialling opportunities relevant to CTS courses in Energy and Mines is provided in "Credentialling Opportunities in Energy and Mines."

Further information regarding these and other credentialling opportunities available to CTS students is provided in the *Career & Technology Studies Manual for Administrators, Counsellors and Teachers* (see Appendix 14: Credentialling Opportunities in CTS), and also through Alberta Education's web site at <http://ednet.edc.gov.ab.ca>.

LINKAGES – *Energy & Mines: Connections With Other CTS Strands*

Energy and Mines Modules	Other CTS Strands																				
	Agriculture	Career Transitions	Communication Technology	Community Health	Construction Technologies	Cosmetology Studies	Design Studies	Electro Technologies	Enterprise and Innovation	Fabrication Studies	Fashion Studies	Financial Management	Foods	Forestry	Information Processing	Legal Studies	Logistics	Management and Marketing	Mechanics	Tourism Studies	Wildlife
Theme: Social and Cultural Perspectives																					
ENM1010: Overview of Alberta Geology		■																			
ENM2010: Managing Alberta's Resources		■													▤	■					
ENM3010: Energy & the Environment	■	▤												▤	▤					▤	■
Theme: Technology and Applications																					
ENM1020: Nonrenewable Resources		▤						▤		▤				▤	▤				▤		
ENM1050: Renewable Resources		▤						▤		▤				▤	▤				▤		
ENM1060: Consumer Products & Services	▤	▤						▤		▤					▤				▤		
ENM2020: Conventional Oil/Gas 1		▤		▤				▤		▤				▤		▤			▤		
ENM2030: Oil Sands/Heavy Oil/Coal 1		▤		▤				▤		▤				▤		▤			▤		
ENM2040: Metals/Nonmetals 1		▤		▤				▤		▤				▤		▤			▤		
ENM2050: Renewable Energy Technology		▤					▤			▤					▤				▤		
ENM2060: Refining Hydrocarbons		▤						▤		▤									▤		
EnM2070: Refining Rocks & Minerals		▤						▤		■									▤		
EnM2080: Supply & Distribution		▤													▤			▤			
E&M3020: Conventional Oil/Gas 2		▤		▤				▤		▤						▤			▤		
ENM3030: Oil Sands/Heavy Oil/Coal 2		▤		▤				▤		▤						▤			▤		
ENM3040: Metals/Nonmetals 2		▤		▤				▤		▤						▤			▤		
ENM3050: Sustainable Energy		▤													▤						
ENM3060: Petrochemicals		▤						▤		▤									▤		
ENM3070: Industrial Materials		▤						▤		■									▤		
ENM3080: Market Basics & Trends		■													▤			■			
Theme: Management and Conservation																					
ENM1090: Fundamentals of Recycling	■	■			■				■	■				■	■				▤		
ENM1100: Conservation Challenge	■	■												■	■					▤	▤
ENM2090: Energy Designs/Systems 1		■			■		■			■									▤		
ENM2100: Environmental Safety		■												▤	■	■				▤	▤
ENM3090: Energy Designs/Systems 2		■			■		■			■									▤		
ENM3100: Integrated Resource Management	■	■												▤	▤					▤	▤

Provides many direct links with competencies in this strand. Students will reinforce, extend and apply a substantial number of knowledge and/or skill components in practical situations. ■

Provides some links with competencies developed in this strand, usually through the application of related technologies and/or processes. ▤

BEST COPY AVAILABLE

LINKAGES – *Energy & Mines in Junior High*

Course Emphasis	Energy & Mines Modules	Forestry Modules	Fabrication Studies Modules	Mechanics Modules
Conservation and Management (3 modules)	Fundamentals of Recycling *ENM1090* Conservation Challenge *ENM1100*	Forests Forever 1 *FOR1100*		
Conventional Exploration and Recovery (6 modules)	Overview of Alberta Geology *ENM1010* Nonrenewable Resources *ENM1020* Conventional Oil/Gas 1 *ENM2020* Supply & Distribution *ENM2080*	Mapping & Aerial Photos *FOR1050*		Mechanical Systems *MEC1130*
Refining and Manufacturing Processes (4 modules)	Consumer Products & Services *ENM1060* Refining Hydrocarbons *ENM2060* Environmental Safety *ENM2100*		Production Systems *FAB1160*	
Renewable Energy (5 modules)	Overview of Alberta Geology *ENM1010* Renewable Resources *ENM1050* Renewable Energy Technology *ENM2050*		Basic Tools & Materials *CON1010*	Mechanical Systems *MEC1130*

LINKAGES – *Energy & Mines in Senior High*

Course Emphasis	Energy and Mines Modules	Forestry/Design Modules	Fabrication/ Mechanics Modules	Career Transitions Modules
Conventional Exploration (3 credits) Prerequisite: None	Overview of Alberta Geology *ENM1010* Conventional Oil/Gas 1 *ENM2020*	Mapping & Aerial Photos *FOR1050*		
Conventional Recovery and Production (5 credits) Prerequisite: Conventional Exploration	Managing Alberta's Resources *ENM2010* Conventional Oil/Gas 2 *ENM3020* Supply & Distribution *ENM2080* Environmental Safety *ENM2100*			Workplace Safety (Practices) *CTR2210*
Mineral Refining and Manufacturing (5 credits) Prerequisite: None	Refining Rocks & Minerals *ENM2070* Industrial Materials *ENM3070* Market Basics & Trends *ENM3080*		Production Systems *FAB1160* Mechanical Systems *MEC1130*	
Energy Design and Conservation (3 credits) Prerequisite: None	Energy Designs/ Systems 1 *ENM2090* Energy Designs/ Systems 2 *ENM3090*	2-D Design Fundamentals *DES1030*		
Environmental Management (6 credits) Prerequisite: None	Managing Alberta's Resources *ENM2010* Environmental Safety *ENM2100* Integrated Resource Management *ENM3100*	Users in the Forest *FOR2120*		Project 2A *CTR2110* Project 2B *CTR2120*

Across the Curriculum

Energy and Mines Modules	Junior High							Senior High											
	Language Arts	Social Studies	Mathematics	Science	Health & PLS	Physical Education	Fine Arts	English	Social Studies	Mathematics	Science (General)	Biology	Chemistry	Physics	CALM	Physical Education	Fine Arts	Social Sciences	Second Language
Theme: Social & Cultural Perspectives																			
ENM1010: Overview of Alberta Geology				■										■	▤				
ENM2010: Managing Alberta's Resources	▤	▤						▤	▤										
ENM3010: Energy & the Environment	▤	▤		▤				▤	▤		▤							▤	
Theme: Technology & Applications																			
ENM1020: Nonrenewable Resources		▤		■					▤		▤		■	■					
ENM1050: Renewable Resources		▤		■					▤		▤		■	■					
ENM1060: Consumer Products & Services		▤		■					▤		▤		■	■					
ENM2020: Conventional Oil/Gas I			▤	▤							▤		■	■	■				
ENM2030: Oil Sands/Heavy Oil/Coal 1			▤	▤							▤		■	■	■				
ENM2040: Metals/Nonmetals 1			▤	■							▤		■	■	■				
ENM2050: Renewable Energy Technology				▤							▤								
ENM2060: Refining Hydrocarbons				▤									■	■	■				
EnM2070: Refining Rocks & Minerals				▤									■	■	■				
EnM2080: Supply & Distribution	▤							▤											
E&M3020: Conventional Oil/Gas 2			▤	▤									■	■	▤				
ENM3030: Oil Sands/Heavy Oil/Coal 2			▤	▤									■	■	▤				
ENM3040: Metals/Nonmetals 2			▤	▤									■	■					
ENM3050: Sustainable Energy	▤							▤											
ENM3060: Petrochemicals				▤									■	■	▤				
ENM3070: Industrial Materials				▤									■	■	▤				
ENM3080: Market Basics & Trends	▤	▤						▤	▤									▤	
Theme: Management & Conservation																			
ENM1090: Fundamentals of Recycling				■							▤		▤	▤					
ENM1100: Conservation Challenge	▤	▤		▤				▤	▤		▤								
ENM2090: Energy Designs/Systems 1			▤	■							▤								
ENM2100: Environmental Safety	▤			▤				▤			▤								
ENM3090: Energy Designs/Systems 2			▤	■							▤								
ENM3100: Integrated Resource Management	▤	▤						▤	▤									▤	

Provides many direct links with course content. Students will reinforce, extend and apply a substantial number of knowledge and/or skill components in practical contexts.	■
Provides some links with course content, usually through the application of related technologies and/or processes.	▤

TRANSITIONS – *Energy & Mines: Related Occupations*

Information for this chart was obtained from the National Occupational Classification (NOC) descriptions.

Educational Requirements:

D:	High School Education	B:	College or Vocational Education
C:	Apprenticeship	A:	University

STRAND-RELATED OCCUPATIONS		EDUCATION REQUIREMENTS			
Occupational Profile	NOC#	D	C	B	A
Bitumen Extraction Plant Operator	9232	✓			
Bitumen Upgrading Plant Operator	?	✓			
Boilermaker	7262		✓		
Central Control and Process Operators, Mineral and Metal Processing	9231	✓			
Commercial Diver	7382	✓			
Drillers and Blasters – Surface Mining, Quarrying and Construction	7372	✓			
Drilling Rig Crews and Service Rig Crews	8232	✓			
Environmental Auditor	2263				✓
Environmental Education Specialist	4169				✓
Environmental Engineer	2148/2263				✓
Field Production Operator	8232			✓	
Foundry Worker	9412	✓			
Gas Pipeline Operator	9232	✓			
Gas Plant Operator	9232			✓	
Geologists, Geochemists and Geophysicists	2113				✓
Geological Engineer	2144				✓
Geological and Mineral Technologists and Technicians	2212			✓	
Hazardous Waste Management Technician	2263			✓	
Inspectors and Testers, Mineral and Metal Processing	9415	✓			
Inspectors, Public and Environmental Health and Occupational Health and Safety	2263				✓
Labourers in Chemical Products Processing and Utilities	9613	✓			
Labourers in Mineral and Metal Processing	9611	✓			
Land Agent	1221			✓	
Machine Operators, Mineral and Metal Processing	9411	✓			
Mechanical Engineer	2132				✓
Manufacturing Manager	2141			✓	✓
Metallurgical and Materials Engineers	2142				✓
Mine Labourer	8614	✓			
Mining Engineer	2143				✓
Mineral Engineering Technologist	2212			✓	
Mining Equipment Operator	8231	✓			
Nondestructive Testers and Inspectors	2261	✓		✓	✓

TRANSITIONS – *Energy & Mines: Related Occupations* (continued)

STRAND-RELATED OCCUPATIONS		EDUCATION REQUIREMENTS			
Occupational Profile	NOC#	D	C	B	A
Nuclear Engineering Technician	2232			✓	
Nuclear Engineer	2132				✓
Oil and Gas Well Drillers, Servicers, Testers and Related Workers	8412	✓			
Oil and Gas Drilling, Servicing and Related Labourers	8615	✓			
Oil and Gas Well Drilling Workers and Services Operators	8412	✓			
Oil Pipeline Operator	8232	✓			
Oil Sands Mining Occupations	8411?	✓			
Petrochemical Engineering Technologist	2211			✓	
Petroleum Engineer	2145				✓
Petroleum Engineering Technologist	2212			✓	
Petroleum, Gas and Chemical Process Operators	9232	✓			
Pollution Control Technician	2231			✓	
Primary Production Managers (except Agriculture)	0811				✓
Refinery/Upgrader Process Operators	9231			✓	
Seismic Crew	8615	✓		✓	
Specialized Oil Field Service Occupations	8232	✓			
Supervisors, Mineral and Metal Processing	9211	✓			
Supervisors, Mining and Quarrying	8221	✓		✓	✓
Supervisors, Oil and Gas Drilling and Services	8222	✓		✓	
Supervisors, Petroleum, Gas and Chemical Processing and Utilities	9212	✓			
Surveying Engineer	2131				✓
Surveying Technologist	2254			✓	
Underground Mine Service and Support Workers	8231	✓			
Underground Production and Development Miners	8231	✓			
Utilities Manager	091				✓
Water and Waste Plan Operators	9424	✓		✓	
Water Well Driller	7374	✓			
Waterworks and Gas Maintenance Workers	7442	✓			
Well Service Pump Equipment Operator Crews	8412	✓			
Wireline Worker	8232	✓		✓	✓

TRANSITIONS – *Energy & Mines: Summary of Post-secondary Programs*

	PUBLIC COLLEGES												PRIVATE COLLEGES					TECH. INST.			UNIVERSITIES				VOCATIONAL COLLEGES			
	Alberta College of Art & Design	Fairview College	Grande Prairie Regional College	Grant MacEwan Community College	Keyano College	Lakeland College	Lethbridge Community College	Medicine Hat College	Mount Royal College	Olds College	Red Deer College	APPRENTICESHIP TRADE	Augustana University College	Canadian Union College	Concordia College	King's University College, The	North American Baptist College	Northern Alberta Institute of Technology	Southern Alberta Institute of Technology	Banff Centre	Athabasca University	University of Alberta	University of Calgary	University of Lethbridge	AVC - Calgary	AVC - Edmonton	AVC - Lac La Biche	AVC - Lesser Slave Lake
Sheet Metal Worker												4y																
Driver Training (including Bus Operator, Commerical, Heavy Transport, Tractor-Trailer, and Transport Truck)					VC																						V	V
Communication Electrician												4y																
Electrical Rewind Mechanic												4y																
Electrician (including Journeyman Updating, and Pre-Employment)		V			8w	C					30w	4y																C(12w)
Other Elecrical Trades (including Electronic Technician, Instrument Mechanic, and Power System Electrician)												4y							28w									
Power Lineman												4y																
Boilermaker												3y																
Heavy Equipment Technicians (including Diesel Mechanics, Industrial Heavy Equipment Technicians/Technology, Journeyman Updating and Pre-Employment		VC			8w	C(16w)	C				30w	4y						CD	C									
Automotive Service Technicians (including Automotives/Automotive Service Technology, Gasoline Engine Performance Analysis and Pre-Employment)		C			8w	C(12w)	D	8w			D	4y						C	VD								C(16w)	
Recreation Vehicle Mechanic												3y																
Small Engine/Light Industrial Mechanic		C																	CD								C(20w)	
Structural Steel and Plate Fitter												3y																
Welder (including First Class to A & B Pressure, Pre-Employment, Upgrading to Journeyman)		V			8w	C(12w)		8w				3y						VC D	D						V		C(22w)	
Power Engineering (including 2nd, 3rd, and 4th Class, and Plant and Process Operations)		VC	VC		V	V												VC	VC D								V	
Heavy Oil Operations Technician						C																						

T NSITIONS – *Energy & Mines: Summary of Post-second rograms* (continued)

	PUBLIC COLLEGES												PRIVATE COLLEGES					TECH. INST.			UNIVERSITIES				VOCATIONAL COLLEGES			
	Alberta College of Art & Design	Fairview College	Grande Prairie Regional College	Grant MacEwan Community College	Keyano College	Lakeland College	Lethbridge Community College	Medicine Hat College	Mount Royal College	Olds College	Red Deer College	APPRENTICESHIP TRADE	Augustana University College	Canadian Union College	Concordia College	King's University College, The	North American Baptist College	Northern Alberta Institute of Technology	Southern Alberta Institute of Technology	Banff Centre	Athabasca University	University of Alberta	University of Calgary	University of Lethbridge	AVC - Calgary	AVC - Edmonton	AVC - Lac La Biche	AVC - Lesser Slave Lake
Land Agent/Petroleum Land Assistant										D									VC						4w			
Petroleum Engineering Fundamentals																			VD									
Safety Resources (including TDG, and WHMIS)						V													V									
Gas Fitter												3y																
Plumber (including Pre-Employment)												4y																C
Sprinkler System Installer												4y																
Steamfitter-Pipefitter (including Upgrading)												4y						V										
Water Well Driller												2y																
Power Engineering (including 2nd, 3rd, and 4th Class, and Plant and Process Operations)		VC	VC		V	V												VC	VC D								V	
Environmental Science (various specializations in Conservation & Reclamation, Environmental Monitoring & Conservation Enforcement, Fish & Wildlife, Parks & Recreation, and Renewable Resource/Watershed Management)					1t	D	CD			CD					B2t	B		D		V		B	CM	B				C(34w)
Environmental Technology/Water & Wastewater Technician									CD									C										C
Petroleum/Mineral Resource/Land Management										D									V	V								

CODES:

B	Bachelor's Degree	D	Diploma (2 years)	w	weeks
M	Master's Degree	V	Varies	m	months
Ph.D.	Doctoral Degree	1t	One-year transfer	y	years
C	Certificate (1 year or less)	2t	Two-year transfer		

*Information adapted from "It's About Time: To Start Thinking About Your Future," Advanced Education and Career Development, 1995.

CREDENTIALLING - *Credentialling Opportunities in Energy and Mines*

The following credentialling opportunities link with modules in the Energy and Mines strand. Further information (including current contacts) for these and other credentialling opportunities available to CTS students is available through Alberta Education's web site at <http://ednet.edc.gov.ab.ca>.

Credential/ Certificate	Training/ Credentialling Agency	Related CTS Strands/Modules	Program Description
Hydrogen Sulphide Alive	Petroleum Industry Training Service (PITS)	ENM: Modules within the "Technology and Applications" theme CTR3040-3080: Practicum Modules CTR2210: Workplace Safety CTR3210: Safety Management Systems	An industry-based credentialling program developed to prevent hydrogen sulphide injuries and fatalities. Deals with basic characteristics of the gas, use of self-contained breathing apparatus, gas-testing devices and rescue techniques. Course addresses both theoretical and practical applications.
The Petroleum Industry in Canada	Petroleum Industry Training Service (PITS)	ENM: Modules within the "Technology and Applications" theme CTR3040-3080: Practicum Modules	An industry-based credentialling program that provides a comprehensive overview of the petroleum industry. Topics addressed include geological and geophysical exploration, land acquisition, drilling systems and methods, well evaluation, completion and production, enhanced recovery, pipelines, oil and gas processing and marketing.
General Entry Level Safety (GELS)	Petroleum Industry Training Service (PITS)	ENM: Modules within the "Technology and Applications" theme CTR3040-3080: Practicum Modules CTR2210: Workplace Safety CTR3210: Safety Management Systems	An industry-based credentialling program developed to ensure worker safety in the petroleum industry. Deals with basic safety, personal protective equipment, back injury prevention, OH & S regulations, hazard identification and elimination, and hand tool safety. Program is available in a self-study video/workbook format.
All Terrain Vehicle Rider	Alberta Safety Council	ENM: Modules within the "Technology and Applications" theme CTR3040-3080: Practicum Modules	An industry-based credentialling program that offers certification in ATV use for recreational or industrial purposes. Deals with pre-ride inspection, range signals, rules and warm up exercises, riding strategies, circles, turns, stops and traversing hills.

Credential/ Certificate	Training/ Credentialling Agency	Related CTS Strands/Modules	Program Description
Transportation of Dangerous Goods (TDG)	Contact Alberta Transportation and Utilities for information regarding approved training/ credentialling agencies.	ENM: Modules within the "Technology and Applications" theme CTR3040-3080: Practicum Modules CTR2210: Workplace Safety	A credentialling program that addresses standards established by the provincial and federal governments for the transportation and handling of dangerous goods. Deals with shipper, receiver and carrier responsibilities, classifications of dangerous goods, marketing and labelling, documentation and reporting responsibilities.
Workplace Hazardous Material Information System (WHMIS)	Contact Alberta Labour (Occupational Health and Safety) for information regarding approved training/ credentialling agencies.	ENM: Modules within the "Technology and Applications" theme CTR3040-3080: Practicum Modules CTR2210: Workplace Safety	A credentialling program that addresses standards established by the provincial and federal governments for the safe use of hazardous materials in the workplace. Develops strategies that will enable the worker to obtain information necessary to protect self, other employees, the premises and the environment from the effects of contamination by hazardous chemicals.

ENERGY AND MINES

SECTION I: LEARNING RESOURCE GUIDE

This section of the GSI has been designed to provide a list of resources that support student learning.

Three types of resources are identified:

- Authorized: Resources authorized by Alberta Education for CTS curriculum; these resources are categorized as basic, support, or teaching
- Other: Titles provided as a service to assist local jurisdictions to identify resources that contain potentially useful ideas for teachers. Alberta Education has done a preliminary review of these resources, but further review will be necessary prior to use in school jurisdictions
- Additional: A list of local, provincial and national sources of information available to teachers, including the community, government, industry, and professional agencies and organizations.

The information contained in this Guide, although as complete and accurate as possible as of June 1997, is time-sensitive.

For the most up-to-date information on learning resources and newer editions/versions, consult the LRDC *Buyers Guide* and/or the agencies listed in the Distributor Directory at the end of this section.

CTS is on the Internet.
Internet Address:
http://ednet.edc.gov.ab.ca

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INTRODUCTION

CTS AND THE RESOURCE-BASED CLASSROOM

Career and Technology Studies (CTS) encourages teachers to establish a resource-based classroom, where a variety of appropriate, up-to-date print and nonprint resources are available. Learning resources identified for CTS strands include print, software, video and CD-ROM formats. Also of significance and identified as appropriate throughout each strand are sources of information available through the Internet.

The resource-based classroom approach accommodates a variety of instructional strategies and teaching styles, and supports individual or small group planning. It provides students with opportunities to interact with a wide range of information sources in a variety of learning situations. Students in CTS are encouraged to take an active role in managing their own learning. Ready access to a strong resource base enables students to learn to screen and use information appropriately, to solve problems, to meet specific classroom and learning needs, and to develop competency in reading, writing, speaking, listening and viewing.

PURPOSE AND ORGANIZATION OF THIS DOCUMENT

The purpose of this document is to help teachers identify a variety of resources to meet their needs and those of the students taking the new CTS curriculum. It is hoped that this practical guide to resources will help teachers develop a useful, accessible resource centre that will encourage students to become independent, creative thinkers.

This document is organized as follows:

- Authorized Resources:
    - – basic learning resources
    - – support learning resources
    - – teaching resources
- Other Resources
- Additional Sources
- Distributor Directory.

Some resources in the guide have been authorized for use in some or all of the CTS strands, e.g., the Career and Technology Studies video series produced by ACCESS: The Education Station. Further information is provided in relevant sections of this resource guide.

Each resource in the guide provides bibliographic information, an annotation where appropriate, and a module correlation to the CTS modules. The distributor code for each entry will facilitate ordering resources. It is recommended that teachers preview all resources before purchasing, or purchase one copy for their reference and additional copies as required.

Distributor Code	Resources		Levels/Mod. No.		
			1	2	3
ACC	Title	Author	1010	2010	3010
	Bibliographic Information				
	Annotation				

1 = Introductory
2 = Intermediate
3 = Advanced

Indicates module number

Distributor Code - see Distributor Directory

HOW TO ORDER

Most authorized resources are available from the Learning Resources Distributing Centre (LRDC) at:

12360 – 142 Street
Edmonton, AB T5L 4X9
Telephone: 403–427–5775 (outside of Edmonton dial 310–0000 to be connected toll free)
Fax: 403–422–9750
Internet: http://ednet.edc.gov.ab.ca/lrdc

Please check LRDC for availability of videos.

RESOURCE POLICY

Alberta Education withdraws learning and teaching resources from the provincial list of approved materials for a variety of reasons; e.g., the resource is out of print; a new edition has been published; the program has been revised. Under section 44 (2) of the *School Act*, school boards may approve materials for their schools, including resources that are withdrawn from the provincial list. **Many school boards have delegated this power to approve resources to school staff or other board employees under section 45 (1) of the *School Act*.**

For further information on resource policy and definitions, refer to the *Student Learning Resources Policy* and *Teaching Resources Policy* or contact:

Learning Resources Unit, Curriculum Standards Branch
Alberta Education
5th Floor, Devonian Building, East Tower
11160 Jasper Avenue
Edmonton, AB T5K 0L2
Telephone: 403–422–4872 (outside of Edmonton dial 310–0000 to be connected toll free)
Fax: 403–422–0576
Internet: http://ednet.edc.gov.ab.ca

Note: Owing to the frequent revisions of computer software and their specificity to particular computer systems, newer versions may not be included in this guide. However, schools may contact the LRDC directly at 403–427–5775 for assistance in purchasing computer software.

Trademark Notices: Microsoft, Access, Excel, FoxPro, Mail, MS-DOS, Office, PowerPoint, Project, Publisher, Visual Basic, Visual C++, Windows, Windows NT, Word, and Works are either registered trademarks or trademarks of Microsoft Corporation. Apple, Mac, Macintosh, and Power Macintosh are either registered trademarks or trademarks of Apple Computer, Inc. Other brand and product names are registered trademarks or trademarks of their respective holders.

AUTHORIZED RESOURCES

BASIC LEARNING RESOURCES

The following basic learning resources have been authorized by Alberta Education for use in the Energy and Mines curriculum. These resources address the majority of the learner expectations in one or more modules and/or levels. A curriculum correlation appears in the right-hand column.

Distributor Code	Resources	Levels/Module No.		
		1	2	3
CAC	*Coal Kit, The.* Calgary, AB: The Coal Association of Canada, 1991. A multi-media kit that covers all facets of the coal industry, including formation of coal, history of the industry, mining techniques, uses of coal, coal exports, health and safety concerns, and environmental issues. The kit includes ***Coal: Fueling the Future***, a 28-minute modular video, a comprehensive package of information sheets, student activity worksheets, maps, graphs and posters, and actual coal samples. The kit is available at no cost upon request from the *Coal Association of Canada*.	1010 1020 1060 1100	2030 2060 2080 2100	3030 3080
LRDC	*Energy: Sources/Applications/Alternatives.* Howard Bud Smith. South Holland, IL: Goodheart-Willcox Co. Inc., 1993. This textbook examines how we extract, process, convert and use energy to power technology. It deals with both conventional and non-conventional energy sources. Various energy-use sectors are analyzed in terms of the demands placed on available energy supplies. Final chapters examine the impact of the energy industry on society, what the future holds as alternative energy sources evolve, and what the future career opportunities might be. Teachers should recognize that this textbook reflects the American energy sector. Information will need to be applied to Canadian society. Workbook/laboratory manual and instructor's manual are available.	1020 1050 1060	2020 2030 2050 2060 2080 2090	3030 3050 3060 3080 3090 3100
LRDC	*Fundamentals of Petroleum.* (3rd Edition.) A. Baker, et al. Petroleum Extension Service, 1996. This text provides an overall view of the petroleum industry in terms that can be understood by the layman as well as the professional. It is a basic guide on practical aspects of the petroleum industry designed for training purposes. Although it does not give a detailed description of oilfield operations. It provides a basic discussion of the petroleum industry from geology through exploration, drilling, production, transportation, refining and processing, marketing and economics.	1010 1020	2020 2030 2060 2080	3030 3060 3080 3100
LRDC	*Introduction to the Petroleum Industry, An.* A. Fagan. Government of Newfoundland and Labrador, 1991. This basic textbook provides an introductory understanding of the petroleum industry: where it started; why it is important; and how it works. It takes the student through the different phases of petroleum exploration, development and production and discusses some of the careers associated with the petroleum industry. Each chapter contains several pages of text, followed by review questions and suggested activities.	1010 1020	2010 2020 2080	3010 3020 3100

Basic Learning Resources (continued)

Distributor Code	Resources	Levels/Module No.		
		1	2	3
ACC	*Offshore Oil and Natural Gas.* Atlantic Geoscience Society. Moving Images Distribution, 1992. Examines the formation, discovery and recovery of oil and gas off Canada's East Coast. Animated graphics demonstrate how continental drift resulted in huge offshore basins that filled with sediments to become the ideal environment for oil and gas generation. Shows the depositing of organic material with sediments and its conversion to oil and gas in sandstones. The acquisition and interpretation of seismic data and examination of core samples are explained. The video is accompanied with a discussion guide.	1010	2020 2060	
PCF	*Our Petroleum Challenge, Into the 21st Century.* Robert Bott. Calgary, AB: Petroleum Communication Foundation, 1993. This 62 page booklet (updated periodically) provides a general introduction to the Canadian oil and gas industry. It focuses attention on the role of producers and consumers in the industry. Major aspects of the oil and gas industry covered include: uses of petroleum; characteristics of the Canadian industry; exploration, drilling, production and processing techniques; marketing and transportation; and refining and petrochemical processes.	1010 1020 1060 1100	2020 2030 2060 2080 2100	3010 3030 3060 3080 3100
ACC	*Petroleum: River of Energy.* Edmonton, AB: ACCESS: The Education Station, 1989. This 57 minute video introduces viewers to a broad range of petroleum industry vocations in Alberta. The video is conveniently organized into sections that deal with history, exploration, recovery, marketing and other topics.	1010 1020 1060 1100	2010 2020 2030 2060 2080 2100	3010 3030 3060 3080 3100
PCF	*Science Curriculum Series. (Case Study 1 – Applied Chemistry: The Refining of Crude Oil; Case Study 2 – Environmental Chemistry: From Sour Gas to Natural Gas; Case Study 3 – Wise Use of Petroleum Resources: The Car in Our Daily Lives; Case Study 4 – Industry and Society: The Development of Natural Gas in a Northern Community.)* Bob Killam, et al. Calgary, AB: Petroleum Communication Foundation, 1992. Each case study covers a different aspect of the petroleum industry, and includes background information for the teacher, laboratory activities, black line masters and student activities.		2010 2060 2080 2090 2100	3010 3060 3090 3100

Basic Learning Resources (continued)

Distributor Code	Resources	Levels/Module No.		
		1	2	3
LRDC	*Transportation, Energy, and Power Technology.* Anthony Schwaller. Albany, NY: Delmar Publishers Inc., 1989. This textbook examines basic concepts and principles of transportation, energy and power. Each chapter introduces various scientific and mathematical principles along with technological content. Special features include safety guidelines, key terms, chapter introductions and summaries, technology links, chapter activities and a mathematical appendix. Teachers should recognize that the textbook reflects the American transportation, energy and power sectors. Information will need to be applied to Canadian society. A teacher's guide is available.	1020 1050 1060 1090	2020 2030 2040 2050 2060 2070	3030 3040 3050 3060 3070 3100

SUPPORT LEARNING RESOURCES

The following support learning resources are authorized by Alberta Education to assist in addressing some of the learner expectations of a module or components of modules.

Distributor Code	Resources	Levels/Module No.		
		1	2	3
PCF	*Backgrounder Series. (Gasoline, Natural Gas, Crude Oil, Sour Gas, Petroleum and the Environment, Canada Benefits, Climate Change.)* Bott, Robert. Calgary, AB: Petroleum Communication Foundation, 1992–1994. This series of pamphlets is intended to increase public awareness and understanding of Canada's petroleum industry. Each pamphlet provides an in-depth look at a particular aspect of the industry. The series is current and written in language easily understood by the layperson. Charts and graphs further enhance this resource. Available in print or electronic format.		2020 2060 2080 2100	3010 3060 3080 3100
ACC	*Career and Technology Studies: Key Concepts.* Edmonton, AB: ACCESS: The Education Station. A series of videos and utilization guides relevant to all CTS strands. The series consists of: *Anatomy of a Plan; Creativity; Electronic Communication; The Ethics Jungle; Go Figure; Innovation; Making Ethical Decisions; Portfolios; Project Planning; Responsibility* and *Technical Writing*.	all	all	all
ACC	*Chernobyl Recovery: A Blueprint for International Co-operation.* United Nations. Mississauga, ON: Marlin Motion Pictures Ltd., 1991. This 15 minute video examines the aftermath of the accident at the Chernobyl nuclear power plant. Location shooting highlights the social, economic and environmental consequences that are now just being understood. The video focuses on the need for international co-operation in monitoring radiation levels, ensuring safe drinking water and keeping food free from contamination.		2050	3010 3050 3100
LRDC	*Co-Dependent Ecology.* Midway Productions. Jeflyn Media Consultants, 1993. This video provides a simple recovery guide for the earth starting at home. Billy Wilson takes you on a tour through his home and shows you, room for room, how easy it is to save energy and money while conserving natural resources. The video examines many practical strategies for protecting the environment.	1100		

Support Learning Resources (continued)

Distributor Code	Resources	Levels/Module No.		
		1	2	3
LRDC	*Ecosystems.* B. Herridge and B. Chernin. Gage Educational Publishing, 1995. The 72 page student text provides an illustrated introduction to ecosystems and a more in-depth look at living and non-living factors and the roles they play in ecosystems. The text concludes with examples of human impacts on ecosystems and examines current issues from a variety of perspectives. The 500 page teacher's resource book provides teaching ideas correlated to the student text and suggestions regarding evaluation, supplementary resources and integrated projects. Blackline master, reproducible for classroom use, is available.	1010 1050 1090 1100	2050 2090 2100	3010 3050 3090 3100
LRDC	*Edmonton Beneath Our Feet, A Guide to the Geology of the Edmonton Gegion.* John D. Godfrey, ed. Edmonton, AB: Edmonton Geological Society, 1993. This 150 page book provides geological information about the Edmonton region that applies to other areas of the province. The book is written in a form useful to geologists and engineers, yet is understandable by the general public. It provides practical and scientific information about geological foundations, and serves as a field guide for researching landscapes in much of central Alberta. The book includes sections on the Edmonton region through time, wealth from the ground, learning the ground rules, and geology for viewing.	1010 1020 1050	2020 2030 2040	
ACC	*Energy Choices: Energy, the Pulse of Life.* MediCinema Ltd., 1995. This 43 minute video cassette is divided into two self-contained segments. The first segment outlines the history of our increasing use of energy and resulting environmental problems. The second segment investigates possible solutions through efficiency in energy use and application of more environmentally benign and renewable sources of energy. The video is accompanied with an 80 page Teacher's Guide that provides summaries of each video segment and suggests discussion topics and student activities.	1050 1090 1100	2050 2090	3010 3050 3090 3100
LRDC	*Energy: Sources/Applications/Alternatives.* Howard Bud Smith. South Holland, IL: Goodheart-Willcox Publishing Co. Inc., 1993. Workbook/Laboratory Manual. See Basic Learning Resources for annotation and module correlation.			

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Support Learning Resources (continued)

Distributor Code	Resources	Levels/Module No.		
		1	2	3
TAUT	*Energy Savers Series. (Basement Insulation, Caulking and Weatherstripping, Heating Systems, Attic Insulation, Condensation Concerns, Windows, Ventilating Your Home, Water and Electricity, New Homes, Passive Solar, Wood Heating, Crawlspace Insulation, Storey-and-a-half Insulation and Cool Rooms.)* Calgary, AB: Trans Alta Utilities (Energy Matters Service), 1986–1993. This series of 14 booklets focuses on most areas of energy conservation in the home. Each booklet is easy to read, well organized and contains information relevant to new home design or existing home improvement. Available at no cost upon request.		2050 2090	3010 3050 3090
LRDC	*Exploring Manufacturing.* R. Thomas Wright. South Holland, IL: Goodheart-Willcox Co. Inc., 1993. Text and Student Activity Manual. This text examines the types and properties of materials from which manufactured products are made and how raw materials are extracted from nature and converted into standard stock used in secondary manufacturing. It explains management activities within the manufacturing industry, and concludes with an overview of the history of manufacturing and a look at what the future is likely to hold. An instructor's manual is available.		2040 2070	3040 3070
ACC	*Extraction of Metals, The.* (Science in Focus Series.) Vancouver, BC: THA Media Distributors Ltd., 1994. This 20 minute video explains different methods of extracting iron and aluminium from their respective ores. The video examines differences between metals and alloys, and briefly discusses processes used to recycle these materials.	1060 1090	2070	3040 3070
LRDC	*Facing the Future: Renewable Energy.* Alan Collinson. London, England: Evans Brothers Limited, 1991. This 44 page book provides an introduction to most forms of renewable energy. The book contrasts the environmental impacts of renewable and non-renewable energy resources, and briefly examines energy production issues in Third World countries.	1050	2050	3010 3050 3100
SSC	*From the Mountains to the Sea – A Journey in Environmental Citizenship.* Ottawa, ON: Environment Canada, 1992. Booklet. This student booklet provides a brief directory of various "eco" activities that can be implemented in the community, home and/or school.		2090 2100	3010 3090 3100

Support Learning Resources (continued)

Distributor Code	Resources	Levels/Module No.		
		1	2	3
LRDC	*Global Environment, The.* Steven Sterling and Sue Lyle. Mississauga, ON: Copp Clark Pitman, 1991. This text addresses a broad range of environmental issues within a global context. Issues are examined through a variety of stimulating activities, including case studies, discussion and role-playing.	1100	2090 2100	3010 3050 3090 3100
ACC	*Green Energy.* Films for the Humanities & Sciences, 1988. This video examines some renewable alternatives to petroleum products and explains how biological and organic products like wood chips, corn and garbage can become major sources of energy.	1090	2050 2090	3050
LRDC	*Light Makes Electricity.* Alexander Kolbing and Peter Stiikl. Mississauga, ON: Marlin Motion Pictures Ltd., 1990. This 12 minute video provides a brief introduction to basic concepts and common applications of active and passive solar energy. Teachers should recognize that content developed in the video will need to be related to the Canadian context.	1050 1100		
LRDC	*Living With Technology.* (2nd Edition.) Michael Hacker and Robert Barden. Albany, NY: Delmar Publishers, Inc., 1993. This text examines the impact of technology on our lives, and provides a generic overview of technological resources and systems. The text provides in-depth studies of communication technology, production technology and energy/power technology. The text concludes with how the future will be affected by developments in communications, manufacturing, construction, energy and biotechnology. A teacher's resource guide is available.	1020 1050 1060	2050 2060 2070 2090	3060 3070 3090
TAUT	*Low Energy Home Designs – Design Guidelines and Plans for Energy Efficient Housing.* Edmonton, AB: Alberta Agriculture, 1983. This book provides information that will help the reader to design and build a low energy home. Twenty unique low energy house plans are described and illustrated along with suggestions regarding layout, design, siting, construction and costs. The last section of the book provides detailed information on designing a low-energy home, choosing a construction technique and selecting an appropriate heating system. Planning and technical information is transferable to existing and second-generation housing. Information is well organized and in an easily understood format.		2050 2090	3010 3050 3090

Support Learning Resources (continued)

Distributor Code	Resources	Levels/Module No.		
		1	2	3
LRDC	*Manufacturing Technology.* Stanley A. Komacek, et al. Albany, NY: Delmar Publishers Inc., 1990. This 436 page textbook provides a systems approach to the study of manufacturing. The text addresses manufacturing inputs, processes, outputs and impacts. Special features of the publication include key terms at the beginning of each chapter, boxed articles providing interesting or unusual information related to the topic, chapter summaries and discussion questions, and a complete glossary of terms used throughout.		2040 2070 2080	3040 3070 3080
LRDC	*Modern Petroleum: A Basic Primer on the Industry.* B. Berger and K. Anderson. PennWell Publishing Company. International Press A book written for the non-technical person that presents the story of petroleum in a logical sequence of events. Topics dealt with include exploration, drilling, logging, completion, production, storage, transportation, refining, marketing, petrochemicals and environmental concerns. Technical terms are italicized throughout and explained in a comprehensive glossary. The book includes line drawings, illustrations and photographs.		2020 2060 2080	3060 3080 3010
CGA	*Natural Gas Today: News and Information on Canada's Natural Gas Industry.* Canadian Gas Association. Don Mills, ON: Canadian Gas Association, 1991. This series of 18 fact sheets explains major facets of the natural gas industry. Topics addressed include industry history, drilling and processing techniques, economic perspectives and environmental impacts. Available upon request at no cost.	1020 1060	2020 2060 2080	3080 3100
LRDC	*Nontechnical Guide to Petroleum Geology, Exploration, Drilling and Production.* N. Hyne. PennWell Publishing Company, 1995. Provides a general overview of petroleum formation, exploration, recovery and production. Written using non-technical language. The book is well illustrated with line drawings. Contains a comprehensive glossary of technical terms. Used in the oil patch.	1010 1020 1060	2020 2030 2060 2080 2100	3030 3060 3010
CNA	*Nuclear Facts: Seeking to Generate a Better.* Understanding Canadian Nuclear Association. Toronto, ON: Canadian Nuclear Association, 1991. This series of fact sheets explains major aspects of the nuclear power industry. Each fact sheet is written in easily understood text, and includes appropriate photographs, diagrams and charts. Available at no cost upon request.		2050 2100	3010 3050 3100

Support Learning Resources (continued)

Distributor Code	Resources	Levels/Module No.		
		1	2	3
LRDC	*One-Minute Readings: Issues in Science, Technology and Society.* R.F. Brinkerhopp. Don Mills, ON: Addison-Wesley Publishing Co., 1992. This book contains readings and questions related to issues in science, technology and society. Applications of science are raising difficult questions and are creating problems that cannot be easily answered. The book is intended to give students practice in making the kinds of decisions they will experience in life. Students need a knowledge of science to find the best possible answers. A teacher's manual is available.		2100	3010 3050 3080 3100
LRDC	*Pipelines.* (W5.) CTV/Magic Lantern Communications, 1995. This video examines the problem of corrosion that is threatening Canada's natural gas pipeline network. Ten ruptures have occurred in 13 years with explosions in Manitoba and Ontario. In interviews with the most noted corrosion experts in North America, the cause of this corrosion is discussed as well as how it can be stopped.		2020 2080	
ACC	*Primal Furnace, The.* EPRI. New Dimensions Media, 1988. This video examines the history of geothermal energy. It defines and illustrates the different kinds of geothermal energy available, and discusses where it is available. The video also explores how geothermal energy can be harnessed to serve humankind.	1050	2050	
LRDC	*Primer of Oilwell Drilling, A: A Basic Text of Oil and Gas Drilling.* Revised. (5th edition.) R. Baker. Petroleum Extension Service, 1996. This book clearly explains oil well service and workover operations to the lay person. Focuses attention on well completion, service and workover rig equipment, remedial well work, well clean-out and workover well stimulation, fishing tools and accessories, and analysis, planning and economics. Numerous photos and drawings illustrate equipment, personnel and operations. Service industry "jargon" or technical terms are clearly defined. Poster included.		2020	
LRDC	*Primer of Oilwell Service and Workover.* (3rd edition.) Petroleum Extension Service, 1979. This book clearly explains oil well service and workover operations to the lay person. Focuses attention on well completion, service and well stimulation, fishing tools and accessories, and analysis, planning and economics. Numerous photos and drawings illustrate equipment, personnel and operations. Service industry "jargon" or technical terms are clearly defined.			3020

Support Learning Resources (continued)

Distributor Code	Resources	Levels/Module No.		
		1	2	3
LRDC	*Science Now! Energy.* Edward Fogden. Cheltenham, England: Stanley Thornes (Publishers) Ltd., 1990. This 36 page magazine style text with double-page spreads provides information and activities on energy and heat. Topics addressed include energy and the environment, fossil fuels, nuclear power, hydro-electricity and conservation design.	1020 1050	2030 2050	3010 3050 3100
ACC	*SWAREI: Energy in Alberta – Take Another Look.* Edmonton, AB: Public Affairs Bureau, 1993. This 10 minute video provides an introduction to the use of renewable energy resources in Alberta. The video focuses on projects undertaken by the *Southwest Alberta Renewable Energy Initiative* in the Pincher Creek area, and also reviews the use of renewable energy throughout Alberta. Colourful and active visuals are presented and explained with an easily understood narrative. Teachers should note that this resource should be used in conjunction with other materials and activities that present other points of view and critically examine the perspective presented in this video.	1050	2050	3010 3050 3100
LRDC	*This Living World: Wildlife Habitat.* King Motion Picture Corporation. Edmonton, AB: Recreation, Parks and Wildlife Foundation, 1992. Video. This video informs viewers of the importance of habitat for living things. Interviews provide insight on issues concerning wildlife and its habitat (e.g., the need for ecological literacy, how habitat affects quality of life, the world-wide disappearance of natural habitats).	1100	2100	3010 3100
LRDC	*Wayland Library of Science and Technology, The: Raw Materials.* Robin Kerrod. East Sussex, England: Wayland Publishers Ltd., 1990. This 48 page book investigates the earth's resources, both on land and in the sea, and explains how this wealth is extracted. Content provides an overview of the earth's resources, and focuses on the processing and manufacturing industries in forestry, mining and synthetics. The book is well illustrated with diagrams, photographs and computer-generated images.	1020 1060 1090	2060 2070	3060 3070

TEACHING RESOURCES

The following teaching resources are authorized by Alberta Education to assist teachers in the instructional process.

Distributor Code	Resources	Levels/Module No.		
		1	2	3
LRDC	*Ecosystems.* B. Herridge and B. Chernin. Gage Educational Publishing, 1995. Teacher's Resource Book. See Basic Learning Resources for annotation and module correlation.			
LRDC	*Energy: Sources/Applications/Alternatives.* Howard Bud Smith. South Holland, IL: Goodheart-Willcox Publishing Co., Inc., 1993. Instructor's Manual. See Basic Learning Resources for annotation and module correlation.			
LRDC	*Exploring Manufacturing.* Thomas R. Wright. South Holland, IL: Goodheart-Willcox Co., Inc., 1993. Instructor's Manual. See Support Learning Resources for annotation and module correlation.			
LRDC	*Living With Technology.* (2nd edition.) Michael Hacker and Robert Barden. Albany, NY: Delmar Publishers, Inc., 1993. Teacher's Resource Guide. See Support Learning Resources for annotation and module correlation.			
LRDC	*One-Minute Readings: Issues in Science, Technology and Society.* R.F. Brinkerhopp. Don Mills, ON: Addison-Wesley Publishing Co., 1992. Teacher's Manual. See Support Learning Resources for annotation and module correlation.			
ABEN	*Somebody Should Do Something About This! ... on Energy and the Environment.* Edmonton, AB: Alberta Energy, (Communications Division), 1993. A Teacher's Resource Book. This teacher resource manual in binder format covers major aspects of energy conservation. The manual provides sample student activities, energy fact sheets and an extensive list of additional sources and contacts. Available at no cost upon request.	1090 1100	2090	3010 3080 3090 3100
LRDC	*Transportation, Energy, and Power Technology Teacher's Guide.* Anthony Schwaller. Albany, NY: Delmar Publishers Inc., 1989. See Basic Learning Resources for annotation and module correlation.			

ENERGY & MINES RESOURCES

THEME CODE:
A. Social & Cultural Perspectives
B. Technology & Applications
C. Management & Conservation

FORMAT CODE:
p - Print
v - Video
s - Software

STATUS CODE:
B - Basic
S - Support
T - Teaching
O - Other

LEVEL CODE:
1 - Introductory
2 - Intermediate
3 - Advanced

JR/SR HIGH CODE:
J - Junior High
S - Senior High

LEVEL				1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
THEME				A	B	B	B	C	C	A	B	B	B	B	B	B	B	C	C	A	B	B	B	B	B	B	B	C	C
Module Number	*Format*	*Status*	*Junior/Senior High*	1010 Overview of Alberta Geology	1020 Nonrenewable Resources	1050 Renewable Resources	1060 Consumer Products & Services	1090 Fundamentals of Recycling	1100 Conservation Challenge	2010 Managing Alberta's Resources	2020 Conventional Oil/Gas 1	2030 Oil Sands/Heavy Oil/Coal 1	2040 Metals/Nonmetals 1	2050 Renewable Energy Technology	2060 Refining Hydrocarbons	2070 Refining Rocks & Minerals	2080 Supply & Distribution	2090 Energy Designs/Systems 1	2100 Environmental Safety	3010 Energy & the Environment	3020 Conventional Oil/Gas 2	3030 Oil Sands/Heavy Oil/Coal 2	3040 Metals/Nonmetals 2	3050 Sustainable Energy	3060 Petrochemicals	3070 Industrial Materials	3080 Market Basics & Trends	3090 Energy Designs/Systems 2	3100 Integrated Resource Management
Backgrounder Series	*p*	S	S								X				X		X		X	X	X				X		X		X
Chernobyl Recovery: A Blueprint for International Cooperation	*v*	S	S											X						X				X					X
Coal Kit, The	*P*	B	J/S	X	X		X		X			X			X		X		X			X					X		
Co-Dependent Ecology	*v*	S	J						X																				
Ecosystems				X		X		X	X					X				X	X	X				X				X	X
Text	*p*	S	J/S																										
Teacher's Resource Book	*p*	T	J/S																										
Edmonton Beneath Our Feet, A Guide to the Geology of the Edmonton Region	*p*	S	J/S	X	X	X					X	X	X																
Energy Choices: Part 2: Energy, the Pulse of Life	*v*	S	J/S			X		X	X					X				X		X				X				X	X
Energy Savers Series (series of 14 pamphlets on home energy conservation)	*p*	S	S											X				X		X				X				X	
Energy: Sources/Applications/Alternatives					X	X	X				X	X		X	X		X	X			X	X		X	X		X	X	
Text	*p*	B	J/S																										
Workbook/Laboratory Manual	*p*	S	J/S																										
Instructor's Manual	*p*	T	J/S																										

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Module Number	*Format*	*Status*	*Junior/Senior High*	1010 Overview of Alberta Geology	1020 Nonrenewable Resources	1050 Renewable Resources	1060 Consumer Products & Services	1090 Fundamentals of Recycling	1100 Conservation Challenge	2010 Managing Alberta's Resources	2020 Conventional Oil/Gas 1	2030 Oil Sands/Heavy Oil/Coal 1	2040 Metals/Nonmetals 1	2050 Renewable Energy Technology	2060 Refining Hydrocarbons	2070 Refining Rocks & Minerals	2080 Supply & Distribution	2090 Energy Designs/Systems 1	2100 Environmental Safety	3010 Energy & the Environment	3020 Conventional Oil/Gas 2	3030 Oil Sands/Heavy Oil/Coal 2	3040 Metals/Nonmetals 2	3050 Sustainable Energy	3060 Petrochemicals	3070 Industrial Materials	3080 Market Basics & Trends	3090 Energy Designs/Systems 2	3100 Integrated Resource Management
LEVEL				1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
THEME				A	B	B	B	C	C	A	B	B	B	B	B	B	B	C	C	A	B	B	B	B	B	B	B	C	C
Exploring Manufacturing													X			X							X			X			
Text	*p*	S	S																										
Student Activity Manual	*p*	S	S																										
Instructor's Manual	*p*	T	S																										
Extraction of Metal, The	*v*	S	J/S				X	X								X							X			X			
Facing the Future: Renewable Energy	*p*	S	J/S			X								X						X				X					X
From the Mountains to the Sea: A Journey in Environmental Citizenship	*p*	S	S															X	X	X								X	X
Fundamentals of Petroleum (3rd Ed.)	*p*	B	J/S	X	X						X	X			X		X					X			X		X		X
Global Environment, The	*p*	S	J/S						X									X	X	X				X				X	X
Green Energy	*p*	S	J/S					X						X				X						X					
Introduction to the Petroleum Industry, An	*p*	B	J/S	X	X					X	X						X			X	X								X
Light Makes Electricity	*v*	S	J			X			X																				
Living With Technology (2nd Ed.)					X	X	X							X	X	X		X							X	X		X	
Text	*p*	S	J/S																										
Teacher's Resource Guide	*p*	T	J/S																										

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	Format	*Status*	*Junior/Senior High*	Overview of Alberta Geology	Nonrenewable Resources	Renewable Resources	Consumer Products & Services	Fundamentals of Recycling	Conservation Challenge	Managing Alberta's Resources	Conventional Oil/Gas 1	Oil Sands/Heavy Oil/Coal 1	Metals/Nonmetals 1	Renewable Energy Technology	Refining Hydrocarbons	Refining Rocks & Minerals	Supply & Distribution	Energy Designs/Systems 1	Environmental Safety	Energy & the Environment	Conventional Oil/Gas 2	Oil Sands/Heavy Oil/Coal 2	Metals/Nonmetals 2	Sustainable Energy	Petrochemicals	Industrial Materials	Market Basics & Trends	Energy Designs/Systems 2	Integrated Resource Management
LEVEL				1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
THEME				A	B	B	B	C	C	A	B	B	B	B	B	B	B	C	C	A	B	B	B	B	B	B	B	C	C
Module Number				1010	1020	1050	1060	1090	1100	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100	3010	3020	3030	3040	3050	3060	3070	3080	3090	3100
Low Energy Home Designs - Design Guidelines and Plans for Energy Efficient Housing	*p*	S	S											X				X		X				X				X	
Manufacturing Technology	*p*	S	S										X			X	X						X			X	X		
Modern Petroleum: A Basic Primer on the Industry	*p*	S	S								X				X		X				X				X		X		
Natural Gas Today: News and Information on Canada's Natural Gas Industry	*p*	S	J/S		X		X				X				X		X				X						X		
Nontechnical Guide to Petroleum Geology, Exploration, Drilling and Production	*p*	S	J/S	X	X		X				X	X			X		X		X			X			X				X
Nuclear Facts: Seeking to Generate a Better Understanding	*p*	S	S											X					X	X				X					X
Offshore Oil and Natural Gas	*v*	B	J/S	X							X				X														
One-Minute Readings: Issues in Science, Technology and Society																			X	X				X			X		X
Text	*p*	S	S																										
Teacher's Manual	*p*	T	S																										
Our Petroleum Challenge, Into the 21st Century	*p*	B	J/S	X	X		X		X		X	X			X		X		X	X	X	X			X		X		

ENERGY & MINES RESOURCES

THEME CODE:
A. Social & Cultural Perspectives
B. Technology & Applications
C. Management & Conservation

FORMAT CODE:
p - Print
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STATUS CODE:
B - Basic
S - Support
T - Teaching
O - Other

LEVEL CODE:
1 - Introductory
2 - Intermediate
3 - Advanced

JR/SR HIGH CODE:
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Module Number	*Format*	*Status*	*Junior/Senior High*	1010 Overview of Alberta Geology	1020 Nonrenewable Resources	1050 Renewable Resources	1060 Consumer Products & Services	1090 Fundamentals of Recycling	1100 Conservation Challenge	2010 Managing Alberta's Resources	2020 Conventional Oil/Gas 1	2030 Oil Sands/Heavy Oil/Coal 1	2040 Metals/Nonmetals 1	2050 Renewable Energy Technology	2060 Refining Hydrocarbons	2070 Refining Rocks & Minerals	2080 Supply & Distribution	2090 Energy Designs/Systems 1	2100 Environmental Safety	3010 Energy & the Environment	3020 Conventional Oil/Gas 2	3030 Oil Sands/Heavy Oil/Coal 2	3040 Metals/Nonmetals 2	3050 Sustainable Energy	3060 Petrochemicals	3070 Industrial Materials	3080 Market Basics & Trends	3090 Energy Designs/Systems 2	3100 Integrated Resource Management
LEVEL				1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
THEME				A	B	B	B	C	C	A	B	B	B	B	B	B	B	C	C	A	B	B	B	B	B	B	B	C	C
Petroleum: River of our Energy	*v*	B	J/S	X	X		X		X	X	X	X			X		X		X	X	X	X			X		X		X
Pipelines (W5)	*v*	S	S								X						X												
Primal Furnace, The	*v*	S	J/S			X								X															
Primer of Oilwell Drilling, A (5th Ed.) (comes with poster)	*p*	S	S								X																		
Science Curriculum Series (Case Studies 1-4)	*p*	B	S							X					X		X	X	X	X					X			X	X
Science Now! Energy	*p*	S	J/S		X	X						X		X						X	X			X					
Somebody Should Do Something About This!...on Energy and the Environment	*p*	T	J/S					X	X									X		X							X	X	X
SWAREI: Energy in Alberta - Take Another Look	*v*	S	J/S			X								X						X				X					X
Transportation, Energy, and Power Technology					X	X	X	X			X	X	X	X	X	X					X	X	X	X	X	X			
Text	*p*	B	J/S																										
Teacher's Guide	*p*	T	J/S																										
Wayland Library of Science and Technology, The: Raw Materials	*p*	S	J/S		X		X	X							X	X									X	X			
Wildlife Habitat (This Living World)	*v*	S	J/S						X										X	X									X

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LEVEL				1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
THEME				A	B	B	B	C	C	A	B	B	B	B	B	B	B	C	C	A	B	B	B	B	B	B	B	C	C
OTHER RESOURCES																													
1995 Canadian Minerals Yearbook: Review and Outlook	*p*	O	J/S	X	X		X					X	X													X			
Aggregates	*p*	O	J/S		X								X			X							X						
Aggregates and Our Environment	*p*	O	J/S						X	X									X										X
Alberta's Energy and Mineral Resources	*p*	O	S							X	X	X	X				X				X	X	X				X		
Canada's Natural Gas Industry: Just the Facts	*p*	O	J/S		X		X				X				X		X				X						X		
Caring For the Land Teaching Kit	*p*	O	J					X	X																				
Cars: An Environmental Challenge	*p*	O	J/S						X									X	X	X								X	X
Dictionary of Natural Resource Managment	*p*	O	J/S	X				X	X	X									X	X									X
Dictionary of Petroleum Exploration, Drilling and Production	*p*	O	S								X										X								
Energy in Alberta	*p*	O	S							X	X	X		X	X						X	X			X		X		
Environmental Citizenship Series: Primer on Environmental Citizenship, A	*p*	O	J/S						X										X	X				X					X

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LEVEL				1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
THEME				A	B	B	B	C	C	A	B	B	B	B	B	B	B	C	C	A	B	B	B	B	B	B	B	C	C
Environmental Citzenship Series: Primer on Water, A	*p*	O	S																X	X				X					X
Famous Mineral Localities of Canada	*p*	O	J/S	X	X								X										X						
Fifty More Things You Can Do To Save the Earth	*p*	O	J					X	X																				
Focus On Series	*p*	O	J/S					X	X										X	X									X
From Coal to Kilowatts	*p*	O	J		X		X																						
Green Future: How To Make A World of Difference	*p*	O	J/S					X	X	X									X	X				X					X
Green Guide, the (Series I & II)	*v*	O	S																X	X				X					X
Home Energy Analysis and Tutories (HEAT) Kit, The	*p*	O	S															X										X	
Household Hazardous Wastes Handbook, The	*p*	O	J/S					X	X										X	X									X
How Green Is Your School?	*p*	O	J/S					X	X											X									X
International Petroleum Encyclopedia	*p*	O	S								X	X			X		X				X	X			X		X		
Introduction to Wind Power, An: Its Uses and Potential	*p*	O	J			X			X																				

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LEVEL				1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
THEME				A	B	B	B	C	C	A	B	B	B	B	B	B	B	C	C	A	B	B	B	B	B	B	B	C	C
Land Conservation Education Program	*p*	O	J/S						X										X	X									X
Land Use and Abuse	*p*	O	J/S						X										X	X									X
More Power To You: 105 Energy-Wise Tips From Albertans	*p*	O	J/S					X	X									X		X								X	X
Natural Gas in the Canadian Economy	*p*	O	S														X										X		
Natural Gas. The Natural Choice	*p*	O	J/S		X		X				X				X		X				X						X		
Nimby: To Consume or Conserve in Whose Backyard?	*p*	O	J/S						X										X	X									X
Primer on Waste Management, A	*v*	O	S																X	X									X
Science in Focus Series: Electricity Generation	*v*	O	J/S				X					X		X						X		X							
Science in Focus Series: Oil as a Raw Material	*v*	O	J/S				X								X										X				
Stratagem: Modelling Sustainable Development	*p*	O	S															X		X				X			X	X	X
Water In Alberta: The Living Flow	*p*	O	S																X	X									X
Water Management In Alberta	*p*	O	S																X	X									X
What We Can Do For Our Environment: Hundreds of Things to Do Now	*p*	O	J/S					X	X											X				X					X

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OTHER RESOURCES

These titles are provided as a service only to assist local jurisdictions to identify resources that contain potentially useful ideas for teachers. Alberta Education has done a preliminary review of the resources. However, the responsibility to evaluate these resources prior to selection rests with the user, in accordance with any existing local policy.

Distributor Code	Other Resources	Levels/Module No.		
		1	2	3
CCGP	*1995 Canadian Minerals Yearbook: Review and Outlook.* Canada Communication Group Publishing, 1996. Contains detailed industry statistics and chapters on the major non-fuel minerals, plus coal and uranium. Explores all stages of mineral industry activity from geoscience and exploration, through mining and processing, to markets and consumption. Reviews domestic and international issues that impact on the mineral industry.	1010 1020 1060	2030 2040	3070
ASGA	*Aggregates.* Edmonton, AB: Alberta Sand and Gravel Association, 1994.	1020	2040 2070	3040
ASGA	*Aggregates and Our Environment.* Edmonton, AB: Alberta Sand and Gravel Association, 1994.	1100	2010 2100	3100
ABEN	*Alberta's Energy and Mineral Resources.* Edmonton, AB: Alberta Energy. Booklet.		2010 to 2040 2080	3020 3030 3040 3080
CGA	*Canada's Natural Gas Industry: Just the Facts.* Don Mills, ON: Canadian Gas Association, 1991. Brochure.		2010 2100	
ENED	*Caring For the Land Teaching Kit (Grades 7–9).* Edmonton, AB: Alberta Environmental Protection, Education Branch, 1993. Teacher's Guide and Student Material.	1090 1100		
NEL	*Cars: An Environmental Challenge.* Terri Willis and Wallace Black. Chicago, IL: Children's Press, 1992.	1100	2090 2100	3010 3090 3100
UBCP	*Dictionary of Natural Resource Management.* J. Dunster. UBC Press, 1996. This dictionary provides an up-to-date and comprehensive source of natural resource management terms. It includes more than 6000 entries, extensively cross-referenced and illustrated to provide exact meanings. Encourages terminology from a wide range of disciplines and is based on information obtained from discussions with experts around the world. A useful resource for those involved in managing the planet's natural resources.	1010 1090 1100	2010 2100	3010 3100

Other Resources (continued)

Distributor Code	Other Resources	Levels/Module No.		
		1	2	3
PWP	*Dictionary of Petroleum Exploration, Drilling and Production.* N. Hyne. PennWell Publishing Company, 1991. This dictionary contains words, phrases and abbreviations used in all aspects of upstream petroleum. Topics covered include accounting, legal, and economics, geology, geophysics, geochemistry, drilling, logging, completion, reservoir engineering and production. The dictionary also contains an extensive series of appendices.		2020	3020
ABEN	*Energy in Alberta.* Edmonton, AB: Alberta Energy. Brochure.		2010 to 2060	3020 3030 3060 3080
ENCA	*Environmental Citizenship Series: A Primer on Climate Change.* Christine Hogan, et al. Ottawa, ON: Environment Canada, 1993. Booklet. This instructor source book provides information about climate change, the greenhouse effect, human activities contributing to the greenhouse effect, current scientific initiatives, potential impacts (especially on Canada), and strategies for personal response to the issue. This book will assist the teacher to develop learning projects and programs that address global warming.		2100	3010 3050 3100
ENCA	*Environmental Citizenship Series: A Primer on Environmental Citizenship.* Ottawa, On: Environment Canada, 1993. Booklet. This resource is designed to provide information that will help Canadians make environmentally responsible decisions. It provides short informational anecdotes, maps and charts, and questions/answers designed to provide critical thinking. The resource includes information on ecological processes, relationships of human societies with the environment, and key environmental issues that Canadians face today. The books is one of a series of *Environmental Citizenship Primers.*	1100	2100	3010 3050 3100
FHW	*Famous Mineral Localities of Canada.* Joel D. Grice. Markham, ON: Fitzhenry and Whiteside, 1989. Textbook.	1010 1020	2040	3040
LRDC	*Fifty More Things You Can Do To Save The Earth.* Earthworks Group. Berkeley, CA: Andrews and McMeel, 1989.	1090 1100		
ENED	*Focus On Series (Acidic Deposition, Air Quality, Environment, Greenhouse Effect, Land Reclamation, Ozone Depletion, Pesticides, Pollution, Recycling, Water Conservation).* Edmonton, AB: Alberta Environmental Protection, Education Branch. Booklets.	1090 1100	2100	3010 3100

Other Resources (continued)

Distributor Code	Other Resources	Levels/Module No.		
		1	2	3
TAUT	*From Coal to Kilowatts.* Calgary, AB: TransAlta Utilities. Student booklet and teacher's manual.	1020 1060		
PBC	*Green Future: How To Make A World of Difference.* Lorraine Johnson. Markham, ON: Penguin Books, 1990. Textbook.	1090 1100	2010 2100	3010 3040 3100
ACC	*Green Guide, The (Series I and II).* Edmonton, AB: ACCESS: The Education Station, 1991. Videotapes.		2100	3010 3050 3100
EEAA	*Home Energy Analysis and Tutorial (HEAT) Kit, The.* Edmonton, AB: Alberta Energy, 1988. Teacher reference binder.		2090	3090
ENED	*Household Hazardous Wastes Handbook, The.* Edmonton, AB: Alberta Special Waste Management Corporation, 1991. Booklet.	1090 1100	2100	3010 3100
OCV	*How Green Is Your School?* Don E. McAllister. Ottawa, ON, Ocean Voice, 1991. Booklet.	1090 1100		3010 3100
PWP	*International Petroleum Encyclopedia.* PennWell Publishing Co., 1996. A comprehensive 335 page publication in full color with current industry information. Includes an atlas section, articles on timely industry issues, and reports on oil and gas technology and current industry statistics. The encyclopedia covers topics on crude oil assays, refining and international active rigs, gas production and seismic crew. Provides a listing of national oil companies, government agencies and energy ministers.		2020 2030 2060 2080	3020 3030 3060 3080
TAUT	*Introduction to Wind Power, An: Its Uses and Potential.* Alberta Agriculture and TransAlta Utilities. Calgary, AB: TransAlta Utilities, 1986. Booklet.	1050 1100		
ENED	*Land Conservation Education Program.* Edmonton, AB: Alberta Environmental Protection, Education Branch. Teacher's guide and student materials.	1100	2100	3010 3100
NEL	*Land Use and Abuse.* Terri Willis. Chicago, IL: Childrens Press, 1992. Textbook.	1100	2100	3010 3110

Other Resources (continued)

Distributor Code	Other Resources	Levels/Module No.		
		1	2	3
TAUT	*More Power to You: 105 Energy–Wise Tips From Albertans.* Calgary, AB: TransAlta Utilities. Student booklet.	1090 1100	2090	3010 3090 3100
CGA	*Natural Gas in the Canadian Economy.* Don Mills, ON: Canadian Gas Association, 1992. Booklet.		2080	3080
CGA	*Natural Gas. The Natural Choice.* Don Mills, ON: Canadian Gas Association, 1990. Booklet.	1020 1060	2020 2060 2080	3020 3080
EEAA	*Nimby: To Consume or Conserve in Whose Backyard?* Edmonton, AB: Alberta Environment. Board Game and Simulation Activity.	1100	2110	3010 3100
SSC	*Primer on Waste Management, A.* Ottawa, ON: Environment Canada, 1993. Booklet.		2100	3010 3110
THA	*Science in Focus Series: Electricity Generation.* Vancouver, BC: THA Media Distributors Ltd., 1993. Video.	1060	2030 2050	3010 3030
THA	*Science in Focus Series: Oil as a Raw Material.* Vancouver, BC: THA Media Distributors Ltd., 1993. Video.	1060	2060	3060
EEAA	*Stratagem: Modelling Sustainable Development.* Edmonton, AB: Alberta Energy. Classroom Kit.		2090	3010 3050 3080 3090 3100
ENED	*Water In Alberta: The Living Flow.* Edmonton, AB: Alberta Environmental Protection, Education Branch, 1993. Teacher's Resource Kit.		2100	3010 3100
EPPC	*Water Management in Alberta.* Edmonton, AB: Alberta Environment, 1991. Booklet.		2100	3010 3100
SSC	*What We Can Do For Our Environment?: Hundreds of Things To Do Now.* (4th edition.) Hull, PQ: Environment Canada, Minister of Supply and Services, 1991. Booklet.	1090 1100		3010 3050 3100

ADDITIONAL SOURCES

Available to Career and Technology Studies (CTS) teachers, locally and provincially, are many sources of information that can be used to enhance CTS. These sources are available through the community (e.g., libraries, boards, committees, clubs, associations) and through government agencies, resource centres and organizations. Some sources, e.g., government departments, undergo frequent name and/or telephone number changes. Please consult your telephone directory or an appropriate government directory.

The following is a partial list of sources to consider:

TEACHER-LIBRARIANS

Planned and purposeful use of library resources helps students grow in their ability to gather, process and share information. Research activities require access to an adequate quantity and variety of appropriate, up-to-date print and nonprint resources from the school library, other libraries, the community and additional sources. Some techniques to consider are:

- planning together
- establishing specific objectives
- integrating research skills into planning.

Cooperation between the teacher-librarian and the subject area teacher in the development of effectively planned resource-based research activities ensures that students are taught the research skills as well as the subject content. Also see *Focus on Research: A Guide to Developing Student's Research Skills* referenced in the Alberta Education resources section.

ALBERTA EDUCATION SOURCES

Alberta Government telephone numbers can be reached toll free from outside Edmonton by dialing 310–0000.

The following monographs are available for purchase from the Learning Resources Distributing Centre. Refer to the Distributor Directory at the end of this section for address, telephone, fax and Internet address.

Please consult the "Support Documents" section or the "Legal, Service and Information Publications" section in the LRDC *Buyers Guide* for ordering information and costs.

Developmental Framework Documents

- *The Emerging Student: Relationships Among the Cognitive, Social and Physical Domains of Development*, 1991 (Stock No. 161555)

  This document examines the child, or student, as a productive learner, integrating all the domains of development: cognitive, social and physical. It emphasizes the need for providing balanced curriculum and instruction.

- *Students' Interactions Developmental Framework: The Social Sphere*, 1988 (Stock No. 161399)

  This document examines children's perceptual, structural and motor development and how such physical development affects certain learning processes.

- *Students' Physical Growth: Developmental Framework Physical Dimension*, 1988 (Stock No. 161414)

  This document examines children's normal physical growth in three areas: perceptual, structural and motor development. In none of these areas is the child's growth in a single continuous curve throughout the first two decades of life. Physical growth is characterized by periods of rapid growth and periods of slower growth. Consequently, differences and changes in growth patterns may affect the timing of certain learning processes.

Other

- *Focus on Research: A Guide to Developing Students' Research Skills*, 1990 (Stock No. 161802)

  This document outlines a resource-based research model that helps students manage information effectively and efficiently, and gain skills that are transferable to school and work situations. This model provides a developmental approach to teaching students how to do research.

- *Teaching Thinking: Enhancing Learning*, 1990 (Stock No. 161521)

  Principles and guidelines for cultivating thinking, ECS to Grade 12, have been developed in this resource. It offers a definition of thinking, describes nine basic principles on which the suggested practices are based, and discusses possible procedures for implementation in schools and classrooms.

ACCESS: The Education Station

ACCESS: The Education Station offers a variety of resources and services to teachers. For a nominal dubbing and tape fee, teachers may have ACCESS: The Education Station audio and video library tapes copied. ACCESS: The Education Station publishes listings of audio and video cassettes as well as a comprehensive programming schedule.

Of particular interest are the CTS videos, which are available with utilization guides. The guides outline key points in each video and suggest questions for discussion, classroom projects and other activities. Video topics are listed in the Support Learning Resources section of this guide. The videos and accompanying support material can be obtained from ACCESS: The Education Station. Refer to the Distributor Directory at the end of this section for address, telephone, fax and Internet address.

GOVERNMENT SOURCES

National Film Board of Canada (NFB)

The NFB has numerous films and videotapes that may be suitable for Career and Technology Studies strands. For a list of NFB films and videotapes indexed by title, subject and director, or for purchase of NFB films and videotapes, call 1-800-267-7710 (toll free) or Internet address: http://www.nfb.ca

ACCESS: The Education Station and some school boards have acquired duplication rights to some NFB videotapes. Please contact ACCESS: The Education Station or consult the relevant catalogues in your school or school district.

The Edmonton Public Library and the Calgary Public Library have a selection of NFB films and videotapes that can be borrowed free of charge with a Public Library borrower's card. For further information, contact:

Edmonton Public Library
Telephone: 403-496-7000

Calgary Public Library
Telephone: 403-260-2650

For further information contact:

Statistics Canada
Regional Office
8th Floor, Park Square
10001 Bellamy Hill
Edmonton, AB T5J 3B6
Telephone: 403-495-3027
Fax: 403-495-5318
Internet address: http://www.statcan.ca

Statistics Canada produces periodicals, reports, and an annual year book.

Resource Centres

Urban Resource Centres

Instructional Services
Elk Island Public Schools
2001 Sherwood Drive
Sherwood Park, AB T8A 3W7
Telephone: 403–464–8235
Fax: 403–464-8033
Internet Address: http://ei.educ.ab.ca

Learning Resources Centre
Red Deer Public School Board
4747 – 53 Street
Red Deer, AB T4N 2E6
Telephone: 403–343–8896
Fax: 403–347–8190

Instructional Materials Centre
Calgary Separate School Board
6220 Lakeview Drive SW
Calgary, AB T3E 5T1
Telephone: 403–298–1679
Fax: 403–249–3054

School, Student, Parent Services Unit
Program and Professional Support Services Sub Unit
Calgary Board of Education
3610 – 9 Street SE
Calgary, AB T2G 3C5
Telephone: 403–294–8542
Fax: 403–287–9739

After July 1, 1997, please contact the School, Student, Parent Services Unit regarding the relocation of the Loan Pool Resource Unit.

Learning Resources
Edmonton Public School Board
Centre for Education
One Kingsway Avenue
Edmonton, AB T5H 4G9
Telephone: 403–429–8387
Fax: 403–429–0625

Instructional Materials Centre
Medicine Hat School District No. 76
601 – 1 Avenue SW
Medicine Hat, AB T1A 4Y7
Telephone: 403–528–6719
Fax: 403–529–5339

Resource Centre
Edmonton Catholic Schools
St. Anthony's Teacher Centre
10425 – 84 Avenue
Edmonton, AB T6E 2H3
Telephone: 403–439–7356
Fax: 403–433–0181

Instructional Media Centre
Northern Lights School Division No. 69
Bonnyville Centralized High School
4908 – 49 Avenue
Bonnyville, AB T9N 2J7
Telephone: 403–826–3366
Fax: 403–826–2959

Regional Resource Centres

Zone 1

Zone One Regional Resource Centre
P.O. Box 6536
10020 – 101 Street
Peace River, AB T8S 1S3
Telephone: 403–624–3187
Fax: 403–624–5941

Zone 2/3

Central Alberta Media Services (CAMS)
182 Sioux Road
Sherwood Park, AB T8A 3X5
Telephone: 403–464–5540
Fax: 403–449–5326

Zone 4

Information and Development Services
Parkland Regional Library
5404 – 56 Avenue
Lacombe, AB T4L 1G1
Telephone: 403–782–3850
Fax: 403–782–4650
Internet Address: http://rtt.ab.ca.rtt/prl/prl.htm

Zone 5

South Central Alberta Resource Centre (SCARC)
Golden Hills Regional Division
435A Hwy 1
Westmount School
Strathmore, AB T0J 3H0
Telephone: 403–934–5028
Fax: 403–934–5125

Zone 6

Southern Alberta Learning Resource Centre (SALRC)
Provincial Government Administration Building
909 Third Avenue North, Room No. 120
Box 845
Lethbridge, AB T1J 3Z8
Telephone: 403–320–7807
Fax: 403–320–7817

OTHER GOVERNMENT SOURCES

Agriculture Canada

Website: www.agr.ca

Communications Branch
930 Carling Avenue
Sir John Carling Bldg.
Ottawa, ON K1A 0C5
Telephone: 613–759–1000
Fax: 613–759–6726
E-mail: pirs@em.agr.ca

General and Technical Publications (a comprehensive listing of free and inexpensive print materials on a variety of topics; updated each year).

Alberta Advanced Education and Career Development
Information Development and Marketing
9th Floor, City Centre Building
10155 – 102 Street
Edmonton, AB T5J 4L5
Telephone: 403–422–1794
Fax: 403–422–5319
E-mail: careerinfo@aecd.gov.ab.ca

Alberta Careers Beyond 2000
Alberta Careers Beyond 2000: Industry Sector Profiles
Alberta Careers Beyond 2000: Occupational Profiles

Videos on career planning and entrepreneurial topics are available through the library of this department. Call 403–422–4752 for more information. The following videos are representative of the library's holdings:
The Entrepreneur
Get a Job
A Head for Business
The Seven Phases of a Job Interview.

Alberta Energy

Website: www.energy.gov.ab.ca
(This website also links to the Alberta Energy and Utilities Board – AEUB).

Alberta Geological Survey
6th Floor, 9945 – 108 Street
Edmonton, AB T5K 2G6
Telephone: 403–422–1927
Fax: 403–422–1459

Rock Chips (a newsletter published by the Alberta Geological Survey for the geoscience community of Alberta)
Communications Branch
9945 – 108 Street
Edmonton, AB T5K 2G6
Telephone: 403–427–8697
Fax: 403–422–0800

Alberta in the Global Energy Spectrum
Somebody…Should Do Something About This! A Teacher's Resource Book on Energy and the Environment

Alberta Energy & Utilities Board
Information Services
640 – 5 Avenue SW
Calgary, AB T2P 3G4
Telephone: 403–297–8190
Fax: 403–297–7040

A *Catalogue of Publications, Maps and Services* is available upon request.

Alberta Environmental Protection

Website: www.gov.ab.ca/~env/index.hmtl

Strategic and Regional Support
Education Branch
(handles inquiries formerly directed to the Environmental Council of Alberta)
11th Floor, South Petroleum Plaza
9915 – 108 Street
Edmonton, AB T5K 2G8
Telephone: 403–427–6310
Fax: 403–422–5136
E-mail: envedu@env.gov.ab.ca

Land Conservation Education Program
Pesticide Education Program
The Water Literacy Program
Focus On Series
Poster Education Series
Workshops and presentations on these program materials can be arranged.

Communications Division
9th Floor, Petroleum Plaza, South Tower
9915 – 108 Street
Edmonton AB T5K 2G8
Telephone: 403–427–8636
Fax: 403–422–6339

EP LINK (a newsletter about projects, programs and activities undertaken by Alberta Environmental Protection staff)

Alberta Research Council

Website: www.arc.ab.ca

Mailing Address:
P.O. Box 8330
Edmonton. AB T6H 5X2

Street Address:
250 Karl Clark Road
Edmonton. AB T6H 5X2
Telephone: 403–450–5111
Fax: 403–450–1490

Environment Canada
Inquiry Centre
351 St. Joseph Blvd.
Hull PQ K1A 0H3
Telephone: 819–997–2800
Fax: 613–953–2225

Action 21
27th Floor, #10 Wellington Street
Hull PQ K1A 0H3
Telephone: 1–800–668–6767

Environmental Citizenship Series:
- *A Primer on Environmental Citizenship*
- *The Nature of Canada: A Primer on Spaces and Species*
- *A Primer on Climate Change*
- *A Primer on Water*

Industry Canada
(handles inquiries formerly directed to Industry & Science Canada)

Website: http://strategis.ic.gc.ca

Northern Region
540 Canada Place
9700 Jasper Avenue
Edmonton, AB T5J 4C3
Telephone: 403–495–4782

Or

Southern Region
#400, 639 – 5th Avenue SW
Calgary AB T2P 0M9
Telephone: 403–292–4575

Natural Resources Canada
Distribution Section
Communications NRCan
580 Booth Street, 20th Floor
Ottawa ON K1A 0E4
Telephone: 616-992-0759 / 616-995-6783
Fax: 616-996-9094

Canadian Energy Education Directory
An extensive *Publications List* is available upon request.

PROFESSIONAL ASSOCIATIONS

Alberta Society of Engineering Technologists
Website: http://aset.worldgate.com
2100 Canada Trust Tower
10104 – 103 Avenue
Edmonton AB T5J 0H8
Telephone: 403-425-0626
Fax: 403-424-5053
E-mail: asetadmin@worldgate.com

Alberta Teachers' Association
Barnett House
11010 – 142 Street
Edmonton AB T5N 2R1
Telephone: 403-453-2411
1-800-232-7208
Fax: 403-455-6481
Website: www.teachers.ab.ca

CTS Council
Environmental and Outdoor Education Council
Alberta Global Education Project
Science Council

Alberta Land Surveyors Association
2501 CN Tower
10004 – 104 Avenue
Edmonton AB T5J 0K1
Telephone: 403-429-3374
1-800-665-2572

Association of Canada Land Surveyors
Box 5378
Station Merivale #120
162 Cleopatra Drive
Nepean ON K2G 5X2
Telephone: 613-723-9200
Fax: 613-224-9577
E-mail: aclsaatc@magi.com

Association of Professional Engineers, Geologists and Geophysicists of Alberta
15th Floor, Scotia Place, Tower One
10060 Jasper Avenue
Edmonton AB T5J 4A2
Telephone: 403-426-3990
Fax: 403-426-1877

Canadian Association for Chemical Technology
1785 Alta Vista Drive
Ottawa ON K1G 3Y6

Canadian Association of Petroleum Landmen
500 – 4 Avenue SW
Calgary AB T2P 1V6
Telephone: 403-237-6635
Fax: 403-263-1620

Canadian Society of Environmental Biologists
Box 962 Postal Station F
Toronto ON M4Y 2N9

Canadian Society of Petroleum Geologists
505, 206 – 7 Avenue SW
Calgary AB T2P 0W7
Telephone: 403-264-5610
Fax: 403-264-5898

Publications Catalogue
Geological Atlas of Western Canada Sedimentary Basin

Industrial Vegetation Management Association of Alberta
9205 – 37 Avenue
Edmonton AB T6E 5K9
Telephone: 403-541-9600

INDUSTRY ORGANIZATIONS

Alberta Chamber of Resources
1410, Oxford Tower
10235 – 101 Street
Edmonton AB T5J 3G1
Telephone: 403–420–1030
Fax: 403–425–4623
Resources Guide and Directory
The Resources Letter (a quarterly newsletter on current issues)

Alberta Power
Energy Management
10035 – 105 Street
Edmonton AB T5J 2V6
Telephone: 403–420– 8978

Canadian Association of Oil Well Drilling Contractors
#800, 540 – 5 Avenue SW
Calgary AB T2P 0M2
Telephone: 403–264–4311
Fax: 403–263–3796

Produces a catalogue of *Training and Educational Publications for the Oil & Gas Industry.*

Canadian Association of Petroleum Producers
2100, 350 – 7 Avenue SW
Calgary AB T2P 3N9
Telephone: 403–267–1100
Fax: 403–261–4622

Produces a *CAPP Publications List.*

Canadian Energy Pipeline Association

Website: www.cepa.com

1650, 801 – 6 Avenue SW
Calgary AB T2P 3W2
Telephone: 403–221–8777
Fax: 403–221–8760

Canadian Gas Association
55 Scarsdale Road
Don Mills ON M3B 2R3
Telephone: 416–447–6465
Fax: 416–447–7067

Natural Gas Today: News and Information on Canada's Natural Gas Industry

Canadian Petroleum Products Institute
1610, Bow Valley Square One
202 – 6 Avenue SW
Calgary AB T2P 2R9
Telephone: 403–266–7565
Fax: 403–269–9367

Coal Association of Canada
502, 205 – 9 Avenue SE
Calgary AB T2G 0R3
Telephone: 403–262–1544
Fax: 403–265–7604

The Coal Kit is available at no cost to educators.

Petroleum Communication Foundation

Website: www.pcf.ab.ca

214, 311 – 6 Avenue SW
Calgary AB T2P 3H2
Telephone: 403–264–6064
Fax: 403–237–6286
E-Mail: pcomm@pcf.ab.ca

Our Petroleum Challenge: Into the 21st Century
Science Curriculum Series Case Studies
Backgrounder Series
Film and Video Catalogue
Speakers Bureau

Petroleum Industry Training Service
Website: www.pits.ca
Head Office
#13, 2115 – 27 Avenue NE
Calgary AB T2E 7E4
Telephone: 403–250–9606
Fax: 403–291–9408

Or

Nisku Training Centre
P.O. Box 458
1020 – 20 Avenue
Nisku AB T0C 2G0
Telephone: 403–955–7770
Fax: 403–955–2454

Provides a range of publications and training programs relevant to the petroleum industry.

TransAlta Utilities
Communications/Public Affairs
110 – 12 Avenue SW
Box 1900
Calgary AB T2P 2M1
Telephone: 403–267–4930
1–800–267–5300

Energy Matters Service
Alberta Energy Savers Series

OFF CAMPUS FACILITIES

The following facilities may offer opportunities for observation and/or practical experience in aspects of resource management and environmental education. Contact the facility for information regarding programs offered to school groups.

Bellevue Mine/Frank Slide
Frank Slide Interpretive Centre
Box 959
Blairmore AB T0K 0E0
Telephone: 403–562–7388
Fax: 403–562–8635

Bennett Environmental Education Centre
Edmonton Public Schools
9703 – 94 Street
Edmonton AB T6C 3W1
Telephone: 403–468–1439

Core Research Centre
3545 Research Way NW
Calgary AB T2L 1Y7
Telephone: 403–297–6400
Fax: 403–297–5982

The *Core Research Centre* collects, processes and catalogues core and drill cuttings and daily drilling reports received from gas and oil wells in Alberta. Interpretative tours of the facility are available.

Energeum
(Alberta Energy and Utilities Board)
640 – 5 Avenue SW
Calgary AB T2P 3G4
Telephone: 403–297–4293

The *Energeum* is a science museum of energy resources. It provides information about the formation, exploration, recovery and production of oil, natural gas, oil sands, coal, and hydroelectricity.

Environmental Resource Centre
10511 Saskatchewan Drive
Edmonton AB T6E 4S1
Telephone: 403–433–4808

Ft. McMurray Oil Sands Interpretive Centre
515 MacKenzie Blvd.
Ft. McMurray AB T9H 4X3
Telephone: 403–743–7167

Glenbow Museum
130 – 9 Avenue S E
Calgary AB T2G 0P3
Telephone: 403–264–8300

Leduc #1 Museum/Interpretive Centre
C/O Leduc/Devon Historical Society
#6 – 20 Haven Avenue
Devon AB T9G 2B9
Telephone: 403–987–3435

Natural Resources Canada
Western Resource Centre
P.O. Bag 1280
#1 Oil Patch Drive
Devon AB T0C 1E0
Telephone:403–987–8615 (general information)
403–987–8660 (tour bookings)

(This centre is also known as the *Devon Hydrocarbon Coal Research Centre.*)

Pincher Creek Development and Information Centre
1041 Hewetson Avenue
Pincher Creek AB T0K 1W0
Telephone: 403–627–5855
Fax: 403–627–5850
E-mail: pcinfo@canuck.ca

Provides a variety of brochures, pamphlets, tours, presentations and referrals on wind, solar, and small hydro energy.

Royal Tyrell Museum of Palaeontology
Website: http://tyrrell.magtech.ab.ca
Box 7500
Drumheller AB T0J 0Y0
Telephone: 403–823–7707
Fax: 403–823–7131
E-mail: rtmp@dns.magtech.ab.ca

TransAlta Utilities Tour Centre
Box 1, Site 3, RR 1
Duffield AB T0E 0N0
Telephone: 403–731–3996

Tour bookings for all TransAlta facilities are handled through this office.

OTHER AGENCIES

Alberta Safety Council
201, 10526 Jasper Avenue
Edmonton AB T5J 1Z7
Telephone: 403–428–7555
1–800–301–6407
Fax: 403–428–7557

Provides a range of occupational health and safety training programs endorsed by industry partners.

Alberta Science and Technology Hotline

Website: www.cadvision.com/calg_sci_net

Peace River Hotline, Northwest Alberta
Telephone: 403–539–9847
Fax: 403–539–0522

Northeast Alberta, including Edmonton and Red Deer Regions:
Telephone: 403–448–0055
Fax: 403–453–2711

Calgary Region
Telephone: 403–263–6226
Fax: 403–230–8488
E-mail: scihot@cadvision.com

Praxis Hotline, Medicine Hat Region
Telephone: 403–526–4237

The *Alberta Science and Technology Hotline* provides teachers with a direct line to the science community to access information and expertise.

Biomass Energy Institute
1329 Niakwa Road East
Winnipeg MB R2J 3T4
Telephone: 204–257–3891

Canadian Foundation for Economic Education
501, # 2 St. Clair Avenue West
Toronto ON M4V 1L5
Telephone: 416–968–2236
Fax: 416–968–0488

Environomics: Exploring links between the economy and the environment
Entrepreneurship: A Primer for Canadians
Labour Market: Teacher's Resource Package

Canadian Geoscience Education Network
c/o Geological Survey of Canada
3303 – 33 Street NW
Calgary AB T2L 2A7
Telephone: 403–292–7079
Fax: 403–292–6014
E-Mail: nowlan@gsc.emr.ca

Canadian Nuclear Association
725, 144 Front Street West
Toronto ON M5J 2L7
Telephone: 1–800–387–4477

Canadian Wind Energy Association
One, 153 – 3rd Avenue
Ottawa ON K1S 2J9
Telephone: 616–234–9463

Edmonton Recycling Society
11631 – 80 Street
Edmonton AB T5B 2N3
Telephone: 403–471–0071

Energy Efficiency Association of Alberta
P.O. Box 41152
Edmonton AB T6J 6M7
Telephone: 403–448–0035
Fax: 403–463–2360

Home Energy Analysis Tutorial

Energy Society of Canada
3, 15 York Street
Ottawa ON K1N 5S7
Telephone: 616–236–4594

FEESA, An Environmental Education Society

Website: www.telusplanet.net/public/feesa

900, 10150 – 100 Street
Edmonton AB T5J 0P6
Telephone: 403–421–1497
Fax: 403–425–4506
E-mail: feesa@telusplanet.net

FEESA offers education training and resource materials focusing on a variety of environmental and educational needs. Programs are developed in partnership with business, industry, government, environmental and education groups.

Green Teacher

Website: www.web.ca/~greentea/

95 Robert Street
Toronto ON M5S 2K5
Telephone: 416–960–1244
Fax: 416–925–3474
E-mail: greentea@web.ca

A magazine by and for educators to enhance environmental and global education across the curriculum.

Paper Chase Recycling
21255 William Short Road
Edmonton AB T5B 2E1
Telephone: 403–477–9391

Offers a comprehensive program on recycling.

The Pembina Institute for Appropriate Development

Website: www.dvnet.drayton-valley.ab.ca/environ.pembina.htm

P.O. Box 7558
Drayton Valley AB T7A 1S7
Telephone: 403–542–6272
Fax: 403–542–6464
E-mail: piad@ccinet.ab.ca

The Canadian Environmental Education Catalogue.

Pennwell Publishing Co.

Website: www.pennwell.com

P.O. Box 21288
Tulsa Oklahoma 74121 U.S.A.
Telephone: 1–800–752–9764
or 918–831–9421
Fax: 918–831–9555

Publishes a catalogue of books, directories, maps/charts, software, statistics, survey data and videos relevant to the petroleum industry.

Pincher Creek Development and Information Centre
1041 Hewetson Avenue
Pincher Creek AB T0K 1W0
Telephone: 403–627–5855
Fax: 403–627–5850

Provides a variety of brochures, pamphlets, tours, presentations and referrals on renewable energy development.

RADARSAT International

Website: www.rsi.ca

Client Services
3851 Shell Road, Suite 200
Richmond BC V6X 2W2
Telephone: 604–244–0400
Fax: 604–244–0404
E-mail: info@rsi.ca

Provides a range of information, products and services relevant to applications of remote radar satellite sensing technology in gathering environmental and resource data.

Recycle Infoline
(handles inquires previously directed to the Alberta Special Waste Management Corporation)
12th floor South Petroleum Plaza
9915 – 108 Street
Edmonton AB T5K 2G8
Telephone: 1–800–463–6326
Fax: 403–427–0413

Provides information regarding environmental and hazardous wastes.

Sage Foundation

Website: www.ccinet.ab.ca/dc/

744 West Hastings Street, Suite 410
Vancouver BC V6C 1A5
Telephone: 604–669–6298
Fax: 604–669–6222
E-mail: dcbc@sage.bc.ca

A non-profit organization that develops environmental educational programs based on reduce, reuse, and recycle principles.

The Science Alberta Foundation

Website: under construction

2100, 700 – 6th Avenue SW
Calgary AB T2P 0T8
Telephone: 403–260–1996
Fax: 403–260–1165
E-mail: litebulb@supernet.ab.ca

The Science Alberta Foundation promotes science literacy throughout the province. Their programs are hands-on, and include travelling exhibitions and professional development courses.

The SEEDS Foundation
440, 10169 – 104 Street
Edmonton AB T5J 1A5
Telephone: 403–424–0971
Fax: 403–424–2444

Small Power Producers Association of Alberta
Box 59
Claresholm AB T0L 0T0
Telephone: 403–625–2127

Provides a series of videos on renewable energy topics.

ADDITIONAL WEBSITES OF NOTE

Bureau of Economic Geology

http://www.utexas.edu/research/beg

Discovery Place

http://www.worldweb.com/discoveryplace

Gas Research Institute

http://www.gri.org

Global Petroleum Centre

http://www.cadvision.com/oil/gpc.html

Petroleum Technology Transfer Council

http://www.msc.edc/pttc

Schlumberger Ltd.

http://www.slb.com

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DISTRIBUTOR DIRECTORY

The entries in the Distributor Directory are arranged alphabetically by code.

CODE	Distributor/Address	Contact Via
ACC	ACCESS: The Education Station 3270 – 76 Avenue Edmonton, AB T6B 2N9	403–440–7777 Fax: 403–440–8899 1–800–352–8293 http://www.ccinet.ab.ca/access
ABEN	Alberta Energy Communications Branch 14th Floor, Petroleum Plaza North Tower 9945 – 108 Street Edmonton, AB T5K 2G6	403–427–8697 Fax: 403–422–0800
AECD	Alberta Advanced Education and Career Development 10th Floor, Commerce Place 10155 – 102 Street Edmonton, AB T5H 4L5	403–427–8765
ASGA	Alberta Sand and Gravel Association 201, 9333 – 45 Avenue Edmonton, AB T6E 5Z7	403–436–9860 Fax: 403–436–4910
CCGP	Canada Communication Group Publishing Government of Canada 45 Sacre-Coeur Blvd. Room D2200 HULL, QC K1A 0S9	819–956–4800 819–956–1620 Fax: 819–994–1498
CGA	Canadian Gas Association 1200, 243 Consumers Road North York, ON M2J 5E3	416–498–1994 Fax: 416–498–7465
CNA	Canadian Nuclear Association 725, 144 Front Street West Toronto, ON M5J 2L7	416–977–5211 Fax: 416–979–8356
EEAA	Energy Efficiency Association of Alberta P.O. Box 41152 Edmonton, AB T6J 6M7	403–448–0035 Fax: 403–463–2360
ENCA	Environment Canada Terrasses de la Chaudiere 27th Floor, 10 Wellington Street Hull, Quebec K1A 0H3	819–953–1595 Fax: 819–994–1412 1–800–668–6767

Distributor Directory (continued)

CODE	Distributor/Address	Contact Via
ENED	Alberta Environmental Protection, Education Branch 11th Floor, South Petroleum Plaza 9915 – 108 Street Edmonton, AB T5K 2G8	403–427–6310 Fax: 403–422–5136
EPPC	Environmental Protection Information Centre Main Floor 9920 – 108 Street Edmonton, AB T5K 2M4	403–422–2079 Fax: 403–427–4407
FHW	Fitzhenry & Whiteside Ltd. See LRDC *Buyers Guide* for information	
LRDC	Learning Resources Distributing Centre 12360 – 142 Street Edmonton, AB T5L 4X9	403–427–5775 Fax: 403–422–9750 http://ednet.edc.gov.ab.ca/lrdc
NEL	Nelson Canada See LRDC *Buyers Guide* for information	
OCV	Ocean Voice 2883 Otterson Drive Ottawa, ON K1V 7B2	613–996–9915
PBC	Penguin Books Canada Ltd. 1220 Nicholson Road Newmarket, ON L3Y 7V1	905–836–6730 Fax: 905–836–6729 1–800–668–6540
PCF	Petroleum Communication Foundation 214, 311 – 6 Avenue SW Calgary, AB T2P 3H2	403–264–6064 Fax: 403–237–6286
PHGP	Prentice Hall Ginn Publishing Co. 1870 Birchmount Rd. Scarborough, ON M1P 2J7	416–293–3621 1–800–361–6128 Fax: 416–299–2539
PWP	Penn Well Publishing Company 1421 South Sheridan P.O. Box 1260 Tulsa, OK 74112	

Distributor Directory (continued)

CODE	Distributor/Address	Contact Via
TAUT	TransAlta Utilities Community Relations 110 – 12 Avenue SW Box 1900 Calgary, AB T2P 2M1	403–267–7459
THA	T.H.A. Media Suite 307, 1200 West Pender Street Vancouver, BC V6E 2S9	604–687–4215 Fax: 604–688–8349 1–800–661–4919
UBCP	University of British Columbia 6344 Memorial Road Vancouver, BC V6T 1Z2	604–822–5959 Fax: 604–822–6083

ENERGY AND MINES

SECTION J: SAMPLE STUDENT LEARNING GUIDES

The following pages provide background information, strategies and a template for developing student learning guides. Also included at the end of this section are several sample student learning guides for Energy and Mines.

A student learning guide provides information and direction to help students attain the expectations defined in a specified CTS module. It is designed to be used by students under the direction of a teacher.

Many excellent student learning guides (SLGs) are available for use and/or are in the process of being developed. While Alberta Education provides a development template accompanied by some samples, most student learning guide development is being done by individuals and organizations across the province (e.g., school jurisdictions, specialist councils, post-secondary organizations). Refer to the *Career & Technology Studies Manual for Administrators, Counsellors and Teachers* (Appendix 11) for further information regarding student learning guide developers and sources.

Note: A student learning guide is not a self-contained learning package (e.g., Distance Learning Module), such as you might receive from the Alberta Distance Learning Centre (ADLC) or Distance Learning Options South (DLOS).

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- Components of a Student Learning Guide J.3
- Strategies for Developing Student Learning Guides J.4

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SAMPLE STUDENT LEARNING GUIDES

- ENM1050 Renewable Resources J.11
- ENM1100 Conservation Challenge J.19

BACKGROUND INFORMATION

A Student Learning Guide (SLG) is a presentation of information and direction that will help students attain the expectations defined in a specified CTS module. It is designed to be used by students under the direction of a teacher. A SLG is not a self-contained learning package such as you might receive from the Alberta Distance Learning Centre (ADLC) or Distance Learning Options South (DLOS).

Each SLG is based on curriculum and assessment standards as defined for a particular CTS module. Curriculum and assessment standards are defined in this document through:

- module and specific learner expectations (Sections D, E and F)
- assessment criteria and conditions (Sections D, E and F)
- assessment tools (Section G).

The SLG is written with the student in mind and makes sense to the student in the context of his or her CTS program. SLGs are designed to guide students through modules under the direction of the teacher. They can be used to guide:

- an entire class
- a small groups of students
- individual students.

In some instances, the Student Learning Guide may also be used as teacher lesson plans. When using SLGs as teacher lesson plans, it should be noted that they tend to be:

- learner-centred (versus teacher-directed)
- activity-based (versus lecture-based)
- resource-based (versus textbook-based).

Components of a Student Learning Guide

The student learning guide format, as developed by Alberta Education, typically has *seven* components as described below.

1. *Why Take This Module?*

   This section provides a brief rationale for the work the student will do, and also establishes a context for learning (i.e., in relation to the strand, a life pursuit, a specific industry, etc.).

2. *What Do You Need To Know Before You Start?*

   In this section, prerequisite knowledge, skills and attitudes considered necessary for success in the module are identified. Prerequisites may include other modules from within the strand or from related CTS strands, as well as generic knowledge and skills (e.g., safety competencies, the ability to measure/write/draw, prior knowledge of basic information relevant to the area of study).

3. *What Will You Know And Be Able To Do When You Finish?*

   This information must parallel and reflect the curriculum and assessment standards as defined for the module. You may find it desirable to rewrite these standards in less formal language for student use.

4. *When Should Your Work Be Done?*

   This section provides a timeline that will guide the student in planning their work. The timeline will need to reflect your program and be specific to the assignments you give your students. You may wish to include a time management chart, a list of all assignments to be completed, and instructions to the student regarding the use of a daily planner (i.e., agenda book) to organize their work.

5. *How Will Your Mark For This Module Be Determined?*

   This section will interpret the assessment criteria and conditions, assessment standards, assessment tools and suggested emphasis as defined for the module within the context of the projects/tasks completed. Accepted grading practices will then be used to determine a percentage grade for the module—a mark not less than 50% for successful completion. (**Note**: A module is "successfully completed" when the student can demonstrate ALL of the exit-level competencies or MLEs defined for the module.)

6. *Which Resources May You Use?*

   Resources considered appropriate for completing the module and learning activities are identified in this section of the guide. The resources may be available through the Learning Resources Distributing Centre (LRDC) and/or through other agencies. Some SLGs may reference a single resource, while others may reference a range of resources. Resources may include those identified in the Learning Resource Guide (Section I) as well as other sources of information considered appropriate.

7. *Activities/Worksheets*

   This section provides student-centred and activity-based projects and assignments that support the module learner expectations. When appropriately aligned with curriculum and assessment standards, successful completion of the projects and assignments will also indicate successful completion of the module.

Strategies for Developing Student Learning Guides

Prior to commencing the development of a student learning guide, teachers are advised to obtain:

- the relevant Guide to Standards and Implementation
- the student learning guide template.

Information communicated to the student in the SLG must parallel and reflect the curriculum and assessment standards as defined for the module. Therefore, critical elements of the Guide to Standards and Implementation that need to be addressed throughout the SLG include:

- module and specific learner expectations
- assessment criteria and conditions
- assessment standards
- assessment tools.

Additional ideas and activities will need to be incorporated into the student learning guide. These can be obtained by:

- reflecting on projects and assignments you have used in delivering programs in the past
- identifying human and physical resources available within the school and community
- networking and exchanging ideas (including SLGs) with other teachers
- reviewing the range of resources (e.g., print, media, software) identified in the Learning Resource Guide (Section I) for a particular module/strand.

Copyright law must also be adhered to when preparing a SLG. Further information and guidelines regarding copyright law can be obtained by referring to the:

- *Copyright Act*
- *Copyright* and the *Can Copy Agreement*.

A final task in developing a student learning guide involves validating the level of difficulty/ challenge/rigour established, and making adjustments as considered appropriate.

A template for developing student learning guides, also available on the Internet, is provided in this section (see "Student Learning Guide Template," pages J.5–10). Several sample student learning guides are also provided in this section (see "Sample Student Learning Guides," starting on page J.11.

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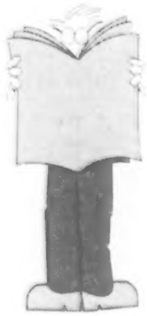
CAREER &
TECHNOLOGY
STUDIES

SAMPLE STUDENT LEARNING GUIDE TEMPLATE

WHY TAKE THIS MODULE?



WHAT DO YOU NEED TO KNOW BEFORE YOU START?

WHAT WILL YOU KNOW AND BE ABLE TO DO WHEN YOU FINISH?

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WHEN SHOULD YOUR WORK BE DONE?

HOW WILL YOUR MARK FOR THIS MODULE BE DETERMINED?

	PERCENTAGE

WHICH RESOURCES MAY YOU USE?

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ACTIVITIES/WORKSHEETS

CAREER & TECHNOLOGY STUDIES

ENERGY AND MINES

SAMPLE STUDENT LEARNING GUIDE

ENM1050 Renewable Resources

ENM1050 Renewable Resources

WHY TAKE THIS MODULE?

- The most commonly used energy sources on earth are non-renewable resources, including coal, oil and natural gas. In Alberta, coal is used to produce almost 90% of our electricity. Natural gas is used for most of our heating, and crude oil is used to produce gasoline, diesel and many other important products.
- Our reserves of nonrenewable energy resources are decreasing. Furthermore, there is increasing concern regarding the environmental effects of burning fossil fuels to produce energy. A number of alternative energy sources are available in Alberta and Canada that have the potential to supplement conventional energy supply.
- This module will examine several renewable sources of energy and related technologies. You will discover benefits and obstacles associated with the use of each, with respect to technological and geological requirements, cost, environmental impact and forecasts regarding sustainability.

WHAT DO YOU NEED TO KNOW BEFORE YOU START?

There are no prerequisites identified for this module.

However, you should be able to:

- identify major non-renewable energy resources and describe the use of each in Alberta and Canada
- explain how the use of non-renewable resources may affect the atmosphere, land and soil, water and wildlife
- define and give examples of sustainable energy development.

WHAT WILL YOU KNOW AND BE ABLE TO DO WHEN YOU FINISH?

Upon completion of this module you will be able to:

- describe applications of renewable energy technology
- explain current and potential contributions of renewable energy to sustainable energy development
- identify career opportunities relevant to renewable energy development
- demonstrate basic competencies.

WHEN SHOULD YOUR WORK BE DONE?

Your teacher will give you a timeline for completing tasks and assignments within this module.

You may also wish to use a time-management planning chart to preplan the work that needs to be done in this module. Plan how you will use your class time as well as extra time needed to complete the assignments in this module.

ENM1050 Renewable Resources

HOW WILL YOUR MARK FOR THIS MODULE BE DETERMINED?

	PERCENTAGE
You must first demonstrate **all** of the competencies required for this module. When you have done this, your percentage mark for the module will be determined as follows:	
• Alberta Charts and Reports on Renewable Technologies	20
• Renewable Energy and the Alberta Market	20
• Renewable Energy Policies	20
• Renewable Energy House	35
• Time Management and Teamwork	5

WHICH RESOURCES MAY YOU USE?

- *Somebody Should Do Something About This!*, Alberta Energy, 1992.
- *Energy: Sources/Applications? Alternatives*, Irwin Publishers, 1993.
- *Living With Technology*, Delmar Publishers, 1993.
- *Transportation, Energy and Power Technology*, Delmar Publishers, 1989.
- *Delmar Technology Series: Energy, Power, and Transportation Technology Activities*, Delmar Publishers, 1988.
- *Edmonton Beneath Our Feet: A Guide to the Geology of the Edmonton Region*, Edmonton Geological Society, 1993.
- *Facing the Future: Renewable Energy*, Fitzhenry and Whiteside, 1991.
- *Light Makes Electricity*, Marlin Motion Pictures, 1990.
- *Science Now! Energy*, Copp Clark Pitman, 1990.
- *SWAREI: Energy in Alberta - Take Another Look*, Public Affairs Bureau, 1993.

ENM1050 Renewable Resources

ACTIVITIES/WORKSHEETS

1. Form a group with up to four additional students. The group will be responsible for conducting research on five common forms of renewable energy (e.g., solar, wind, biomass, hydroelectric, geothermal). Each group will be responsible for creating a wall chart of Alberta, on which will be indicated the sites where renewable energy is currently being developed. For each topic the group will create a 250-word overview of the energy source, technologies used to harness the energy, and the status of the industry in Alberta. The wall chart, descriptions and any additional diagrams should be combined into a display that can be mounted in the classroom or elsewhere in the school.

2. Identify five Albertans that have experience with different forms/sources of renewable energy (e.g., residential contractors, architects, engineers, retailers of wood stoves, users of solar and wind energy technology). Create a series of interview questions for each person, asking them about their educational and professional experiences, factors that encouraged them to get involved with renewable energy technologies, and accomplishments/challenges in marketing these technologies. Ask each knowledgeable person to explain how the renewable technology is being marketed. Gather information about how the Alberta market compares to markets in other provinces and countries. Using information gained from the interviews, write a 300-word report on current markets for renewable energy technologies in Alberta. If possible, have a person knowledgeable about renewable energy in your community talk to the class about their experiences and/or work with alternative energy technologies.

   NOTE: There are a number of active renewable energy organizations in Alberta, including the Solar Energy Society of Canada and the Small Power Producers of Alberta. Members of these groups would be excellent sources of information.

3. Contact an agency of the Alberta government (e.g., Alberta Energy, Alberta Environmental Protection, Energy Resources Conservation Board, Alberta Energy and Utilities Board) regarding information about energy policies in the province. Obtain answers to questions such as:

   - Why is coal used to produce about 90% of Alberta's electricity?
   - To what extent are solar, wind and biomass energy sources used to produce electricity in Alberta?
   - What are some benefits and obstacles to the use of alternative energy technologies in Alberta?

   Prepare an oral and/or written report that summarizes questions asked and answers obtained regarding energy policies in Alberta.

4. Design and construct a model of a renewable energy house. Possible technologies include passive solar energy, active solar energy, photovoltaic electricity, solar water heating, ground source heat pumping, wind pumping, wind turbines and wood heating. The household should not require access to natural gas and electrical utilities. Energy efficient construction techniques should be addressed. The house design should be presented as a model and series of drawings that illustrate renewable energy technologies (see *Worksheet #1: Designing a Renewable Energy House*).

ENM1050 Renewable Resources

WORKSHEET 1

DESIGNING A RENEWABLE ENERGY HOUSE

INTRODUCTION

Many buildings in Alberta are being designed using renewable sources of energy. Some of these buildings are constructed in remote areas, far from power lines or natural gas pipelines, so these other sources of energy have to be used. At the present time renewable technologies such as photovoltaic cells and wind turbines are more expensive to use than grid electricity or natural gas. As a result, renewable energy houses are also usually very energy efficient, to use less energy and reduce the cost of living in the house.

As you work through this assignment you will be designing a highly energy efficient, renewable energy house. For each of the following categories, answer the questions to help you decide how to solve the problem in your house. When you are finished the questions, use the information to create two different products: a number of drawings illustrating the house and the technologies you are using, and a small model of the house. The drawings should include a floor plan, a drawing of the front and back of the house and detailed drawings of any special technologies that will be included.

USING RENEWABLE ENERGY

A typical house needs energy for the following jobs: heating the air, heating the water, electricity and fuel for the range. There are a number of ways that renewable energy can be used for each of these jobs. Compare and contrast the cost and benefits of each technology before selecting which you will use in your house. Be prepared to explain your decision.

1. Heating the Air: Most Albertans use a natural gas furnace to heat the air in their homes.
    - How about passive solar energy? How can you design your house to make better use of the sun's heat energy?
    - What abut wood-burning stoves or fireplaces? Can a wood-burning stove or fireplace be used to heat an entire house? If so, how?
    - Would a ground source heat pump work in Alberta? How would this technology affect the design of your house?
    - Are there other ways to heat the air using renewable energy?

2. Heating Water: Most water heaters in Alberta use natural gas.
    - Could you use an active-solar heating system to heat your water? If so, how will that affect the design of your house?
    - Many Alberta settlers used water containers stored on or in wood stoves to heat water. Would this work with new models or wood stoves? How would this affect the design of your house?
    - Can you think of other ways that you could use renewable energy to heat water?

ENM1050 Renewable Resources

3. Electricity: Most Alberta homes are connected to the electrical grid. Electricity is needed in every modern house, so other ways must be found to generate electricity in homes that are not connected to the electrical grid.
   - What about using photovoltaic panels? Could PV panels produce enough electricity for an average Alberta house? How would using photovoltaic panels affect the design of your house?
   - How about using a wind turbine? Is there enough wind in your part of Alberta?
   - A small hydro generator is another option. What sort of water source do you need to use this technology?

4. Cooking: Two types of stoves are common in Alberta: natural gas and electricity. Electric stoves consume a large proportion of the electricity in a house, so other types of stoves may be required.
   - How about wood stoves? How efficient are these stoves for cooking and baking? Could a wood stove be used for space heating, water heating and cooking?
   - Ovens using the sunlight are also available. How do they compare with normal stoves?
   - Do you have any other ideas?

BUILDING ENERGY EFFICIENT HOMES

1. The Building Envelope: The building envelope is the barrier between the space inside the house and the outside elements or the environment. The envelope controls the flow of heat and moisture across this barrier. An inefficient barrier lets heat escape outside in cold weather, and heat to enter the house in hot weather. An energy-efficient building envelope greatly reduces the amount of energy required to heat and cool the house.
   - There should be a layer on the outside of the house that stops the wind from blowing air through the insulation and removing the heat, like a windbreaker over a sweater. What products are available to do this? Will your house have this layer?
   - The insulation is like a sweater, stopping the flow of heat. Generally, the more insulation the walls and ceiling of a house contain, the better. However, there is a point at which the cost of additional insulation no longer makes sense. How much insulation will be in your house? What type of insulation will you use? How will this affect the design of your house?
   - The air in Alberta is very dry, particularly in winter. A healthy house contains moister air than the outside. Wherever air leaks from a house, moisture leaks as well. Efficient homes have a layer called a vapour barrier on the inside of the insulation. What type of vapour barrier will you use? How is a vapour barrier installed to maximize its benefit?
   - A high percentage of the air leakage in a house happens around and through doors and windows. What type of doors will you use, wood or steel? What type of windows will you use to decrease the amount of heat lost through the glass? Where will you put them to maximize the natural light and the amount of passive solar energy that the house receives? How can you reduce the amount of solar energy that enters your house during the summer? What can you do when you install doors and windows to increase their efficiency?

2. Size and Orientation:
   - Larger houses require more energy than smaller houses. How can you design your house so that it will be comfortable to live in, yet be kept fairly small?
   - Which rooms should be on the south side of the house, to take the greatest advantage of natural lighting and passive solar energy?

ENM1050 Renewable Resources

3. Appliances and Lighting:
   - Write a list of all the items in your home that use electricity. Which require the most energy? Since the electricity at your renewable house is limited and probably costly, you will have to reduce your electrical demand as much as possible. Which appliances will you have in your house? Are there any that you can do without? Can you replace some with a more efficient model? How will you design your lighting?

4. Landscaping:
   - From which direction do the prevailing winds blow in Alberta? How could the house be positioned to decrease the effect of the wind? How could you use hills or trees to help break the wind?
   - In the winter you want as much sun shining on your house as possible. In the summer, you want to block the sun. How can your landscaping do this?

DESIGNING YOUR HOUSE

Now that you have figured out how to produce all the energy needed in your home and how you are going to make it energy efficient, the last step is to decide some of the basic features of your house.

- Will your house have a basement? In most houses, the furnace, hot water heater and freezer are found in the basement. In many houses, the basement is just used for storage. Does your house need a basement? What are the advantages and disadvantages of a basement?

- How many storeys will your house have? Which is easier to heat—a large, spread-out house or a smaller, two-storey house? Which is more convenient?

- How many rooms will your house have? Obviously the number of rooms will help decide how big your house will be. How many people will live in your house? Following are lists of rooms that are needed or may be optional, as well as suggested minimum sizes.

Required Rooms
- kitchen (3 m × 3 m)
- eating area (3 m × 3 m)
- bedroom(s) (3 m × 3 m)
- bathroom (3 m × 2 m)
- living room (3 m × 3 m)
- utility room (2.5 m × 2.5 m)
- storage
- Don't forget hallways to connect the rooms, and stairs to connect any storeys. You will need a front and back door, and at least one window in each room.

Optional Rooms
- dining room (3 m × 3 m)
- family room (3 m × 3 m)
- study (3 m × 3 m)
- extra bedrooms
- extra bathrooms

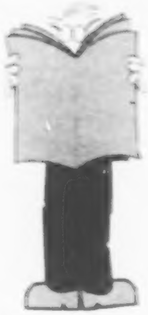
CAREER & TECHNOLOGY STUDIES

ENERGY AND MINES

SAMPLE STUDENT LEARNING GUIDE

ENM1100 Conservation Challenge

WHY TAKE THIS MODULE?



- Energy is all around us. We see it in bright sunshine and when we turn on lights. We feel warm sun and cool wind. We listen to sound produced from electricity in CD players and TVs. We also use mining products every day, from parts in our alarm clock that wake us up, to materials in our pencils we use at school, to the parts in our TVs that we watch at night. Our way of life depends upon energy and mineral resources.
- However, most of our energy and mineral resources are non-renewable resources and are in limited supply. Extracting and using these resources can also affect the environment. In this module you will discover why conserving these resources is necessary. You will also discover a number of ways to conserve energy and mineral resources. By the end of this module you will have developed a plan for changing the way you do many things at home and at school in order to conserve energy and mineral resources.

WHAT DO YOU NEED TO KNOW BEFORE YOU START?

There are no prerequisites identified for this module.

However, you should be able to:

- list and describe common energy and mineral resources. Categorize each resource as renewable or nonrenewable.
- describe the role of non renewable resources life coal, oil and natural gas in producing energy for Albertans.
- explain how electricity is produced in Alberta.
- identify energy sources used by the transportation sectors, and explain how each type of energy is produced.
- identify minerals of economic importance produced in Alberta.
- describe consumer products that are developed from mineral resources.

ENM1100 Conservation Challenge

WHAT WILL YOU KNOW AND BE ABLE TO DO WHEN YOU FINISH?

Upon completion of this module you will be able to:

- describe ways in which energy or mineral development may affect the environment
- identify trends in the consumption of an energy or mineral resource, and explain the objectives of a conservation strategy
- propose personal and shared actions that foster conservation and responsible use of an energy or mineral resource
- demonstrate basic competencies.

WHEN SHOULD YOUR WORK BE DONE?

Your teacher will give you a timeline for completing tasks and assignments within this module.

You may also wish to use a time-management planning chart to preplan the work that needs to be done in this module. Plan how you will use your class time as well as extra time needed to complete the assignments in this module.

ENM1100 Conservation Challenge

HOW WILL YOUR MARK FOR THIS MODULE BE DETERMINED?

	PERCENTAGE
You must first demonstrate all of the competencies required for this module. When you have done this, your percentage mark for the module will be determined as follows:	
• Journal Entries on What YOU are Doing to Conserve Resources	25
• Article File and Graphs	15
• Research on Environmental Impacts	15
• Conservation Career Interviews	15
• Conservation Campaign	25
• Time Management and Teamwork	5

WHICH RESOURCES MAY YOU USE?

- *Somebody Should Do Something About This!*, Alberta Energy, 1992.
- *The Coal Kit*, Coal Association of Canada, 1991.
- *The Global Environment*, Copp Clark Pitman, 1991.
- *Our Petroleum Challenge: Into the 21st Century*, Petroleum Communication Foundation, 1993.
- *A Place for Wildlife, A Way is No Longer There*, ACCESS Network, 1991.
- *Boreal Forest Issues*, Friends of the Environment Education Society of Alberta (FEESA) and ACCESS Network, 1993.
- *Light Makes Electricity*, Marlin Motion Pictures, 1991.
- *Science Show: Forests*, Multi Media Group of Canada, 1990.
- *Science Show: Three Environmental Concerns*, Multi Media Group of Canada, 1991.
- *From the Mountains to the Sea: A Journey in Environmental Citizenship*, Environment Canada, 1992.
- *What We Can do For Our Environment: Hundreds of Things to Do Now*, Environment Canada, 1991.
- *Focus On Series*, Alberta Environmental Protection.

ENM1100 Conservation Challenge

ACTIVITIES/WORKSHEETS

1. Create a personal journal in which you keep a weekly record of your thoughts about conserving energy and mineral resources throughout the module. You should also record ideas you have about ways to conserve energy and mineral resources at home and school. Describe activities and routines you may engage in at home and school to conserve energy or mineral resources.

2. Keep a file of newspaper and magazine articles you find about saving energy or recycling, or about the impacts of energy and mineral development on the environment. Write a 100-word summary of each article. Post the articles and summaries on a bulletin board in your classroom or school. Create a new display each week of news articles and your written summaries.

   Gather data about energy consumption patterns and trends within each of Alberta's residential, commercial, industrial and transportation sectors. Construct and display graphs that depict these consumption patterns.

3. Research one of the following topics:
   - the greenhouse effect
   - ozone depletion
   - acid deposition
   - smog
   - degradation of land and soil by oil spills
   - land disturbance by mines, pipelines and drilling sites.

   Investigate how energy and mineral development influences this environmental phenomena, and steps taken by industry and government to monitor and manage resource development and the environment. Summarize and communicate the information that you gather by one of the following methods:
   - a 500-word magazine article
   - a visual two- and/or three-dimensional display
   - a collaborative video presentation that simulates a television news story.

4. Identify five Albertans who are involved in different energy and mineral resource conservation industries (e.g., building contractor, engineer, architect, recycling worker, building supplies salesperson). Create a series of interview questions, and conduct an interview with each individual either in person or over the phone. Gather information regarding:
   - educational training
   - significance of resource conservation in each occupation
   - specific conservation strategies and techniques being used.

   Create a 250-word report introducing two of the people interviewed to your teacher.

ENM1100 Conservation Challenge

5. Assume that you have been hired to market an energy-saving technology by a product manufacturer. Create a marketing campaign to increase awareness of and potential benefits resulting from the use of any three of the following technologies:
   - compact fluorescent bulb
   - water-saving shower head
   - weatherstripping
   - toilet water-saving device
   - motion detector.

   Each marketing campaign should include:
   - a poster or pamphlet
   - a simulated television commercial on videotape.

   Present the posters, pamphlets and videotape to other persons in the school.

K. ACKNOWLEDGEMENTS

The Energy and Mines strand was developed through the cooperative effort of people from schools, post-secondary institutions, professional associations, business, industry, labour, and departments and agencies of the Government of Alberta. Alberta Education would like to extend sincere appreciation to the following individuals and groups.

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